NAWS CL TP 005

Native Spring Investigation Data Report

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Naval Air Weapons Station China Lake

FOREWORD

The research described in this report was performed at the Naval Air Weapons Station (NAWS) China Lake as part of a native springs investigation conducted during fiscal year (FY) 94. This report documents the data collection and results of water quality, geologic mapping, and aerial resistivity properties for each of 31 native springs investigated.

This work was performed in accordance with NAWS Contract No. N60530-90-D-0071, Delivery Order No. 0020. The results of this report were reviewed for technical accuracy by Thomas Campbell and are final in nature. This report is approved for public release with unlimited distribution.

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(U) A series of native springs in the Indian Wells Valley were investigated by the Naval Air Weapons Station China Lake Environmental Project Office during FY 94 to gather baseline geophysical and geological data. Thirty-one native springs located in the north and south test ranges at China Lake were sampled for water quality. Air photographs of each spring site were taken for geohydrologic interpretation, and the location of each spring was surveyed for its aerial resistivity properties and geologic mapping. These data are presented in this final report.

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CONTENTS

Introduction 3

Data Collection 3
- Water Chemistry/Isotopic Composition 3
- Resistivity Surveys 4
- Geologic Maps 4

Appendixes:
- A. Water Chemistry Graphics 13
- B. Spring Resistivity Surveys 33
- C. Geologic Maps 57

Figures:
1. China Lake Native Spring Study - North Range Index Map 7
2. China Lake Native Spring Study - South Range Index Map 8

Tables:
1. Spring Site Work Accomplished 6
2. NAWS China Lake Native Spring Study Chemical Analysis 9

INTRODUCTION

A series of native springs in the Indian Wells Valley were investigated by the NAWS China Lake Environmental Project Office during FY94 to gather baseline geophysical and geological data. Thirty-one native springs (Table 1) located in the north and south test ranges (Figures 1 and 2) at NAWS China Lake were sampled for water quality. Air photographs of each spring site were taken for geohydrologic interpretation, and the location of each spring was surveyed for its aerial resistivity properties and geologic mapping.

Springs were selected for investigation by their importance as a water resource for the following:

1. Usage by facilities located in remote areas
2. Usage by grazing cattle in remote areas
3. Wildlife usage
4. Feral horse and burro usage

Results from this investigation will be used as a resource for the FY95 NAWS China Lake Spring Management Plan.

DATA COLLECTION

WATER CHEMISTRY/ISOTOPIC COMPOSITION

Water samples were collected from each native spring and analyzed for isotopic composition (oxygen 16:18 ratios, tritium, and deuterium), methylene blue active substances (MBAS), pH, specific conductance, total filterable residue, and general mineral content as follows:

•Aluminum	•Arsenic	•Barium
•Bicarbonate	•Boron	•Bromide
•Cadmium	•Calcium	•Carbonate
•Chloride	•Copper	•Fluoride
•Hydroxide	•Iron	•Lead
•Lithium	•Magnesium	•Manganese
•Mercury	•Nitrates	•Potassium
•Selenium	•Silica	•Silver
•Sodium	•Sulfate	•Total Alkalinity
•Total Anions	•Total Cations	•Total Chromium
•Total Hardness	•Zinc	

Field measurements of pH were recorded with a Hanna pH meter, calibrated at least twice a day using two standard reference solutions. Conductivity was measured with a YSI 3000 TLC meter, calibrated daily. Conductivity and pH readings measured in the field are more accurate representations of existing conditions because bacterial reactions in the sample bottles may occur, which can change the pH readings. A field thermometer was used to record the temperature of each native spring.

Water analyses are presented in Table 2. The important mineral species and isotope compositions of each native spring are graphically highlighted in Appendix A. Spring locations are identified by their assigned number (Table 1), and constituents are reported in milligrams per liter (mg/L). Maximum contaminant levels (MCL) are designated on mineral species with applicable state and federal standards.

RESISTIVITY SURVEYS

Direct current resistivity measurements were completed at 10 spring locations to provide subsurface information that will aid in the interpretation of structural and geohydrologic features that may control the occurrence of each spring.

The surveys were completed with an ABEM Terrameter 300B and several standard electrode arrays. Gradient arrays were set at 800-foot-current electrode separations. A roving receiver dipole was used to map out the areas in between these separations. This array was useful as a "contact finder" in locating features such as basement dikes. Schlumberger depth soundings were used to investigate layering beneath a specific site, such as a water table. Schlumberger profiling was completed by moving a fixed-spacing array along a line of investigation, such as a canyon bottom.

Results of each survey are graphically described as "apparent resistivity" and as graphic symbols superimposed on aerial photographs of the springs. Notations from the survey are included on each graph, such as geographic locations and changes in rock and/or soil types. In the photographic presentations, the width of each profile symbol is proportional to resistivity, thus allowing the reader to correlate resistivity anomalies with features such as joints and faults that are not visible on the United States Geological Survey topographic maps. Plates displaying aerial photographs with resistivity lines superimposed on them are presented in Appendix B.

GEOLOGIC MAPS

Depending on the individual characteristics and aerial extent of each spring, geologic maps were constructed using the following scales:

1. 1 inch equals 50 feet
2. 1 inch equals 100 feet
3. 1 inch equals 150 feet
4. 1 inch equals 200 feet

Aerial stereographic and ground photographs were used in mapping each spring site. The negative scales for the types of films used are as follows:

1. Stereo-imagery in false-color infrared flown at low altitudes: 1 inch equals 300 feet.
2. True-color aerial color film at slightly higher altitudes: 1 inch equals 600 feet.
3. High-altitude false-color photographs: 1 inch equals 1600 feet.

These high-altitude prints, which became available late in the investigation, were extremely useful in providing a more even exposure in areas of steep slopes and deep canyons as a result of higher sun angles.

Each photograph was enlarged with a laser color copier for field use and a digital scanner for computer work. Raster images were overlaid onto the digitized topography to furnish the correct scale and location. These combined ground and photographic interpretations were computer drafted using AutoCad Version 12 and CadOverlay GSX Version 2 to provide a final drawing of each spring site The geologic maps are listed alphabetically by spring name in Appendix C.

TABLE 1. Spring Site Work Accomplished.

Spring no.	Spring name	Chemical analyses	Resistivity survey	Air photos	Geologic maps
1.	Amity	x	x	x	x
2.	Bircham	x	x	x	x
3.	China Gardens	x		x	x
4.	Cole	x	x	x	x
5.	Crystal	x	x	x	x
6.	Darwin	x		x	x
7.	Dead End	x		x	x
8.	Granite Wells	x		x	x
9.	Haiwee	x		x	
10.	Hidden	x		x	x
11.	Indian	x		x	x
12.	Indian Gardens	x	x	x	x
13.	Lamotte	x		x	x
14.	Layton	x		x	x
15.	Lead Pipe	x	x	x	x
16.	Mammoth Mine	x		x	x
17.	Margaret Ann	x		x	x
18.	Mariposa	x	x	x	x
19.	Mesquite	x		x	x
20.	Myrick	x		x	
21.	Newhouse	x	x	x	x
22.	N. Mountain Springs	x		x	x
23.	Old House	x	x	x	x
24.	Pink Hill	x		x	x
25.	Rudy	x		x	x
26.	Seep	x		x	x
27.	Stone Corral	x		x	x
28.	Tennessee	x	x	x	x
29.	Upper Tunnel	x		x	x
30.	Wild Rose	x		x	x
31.	Wilson Canyon	x		x	x

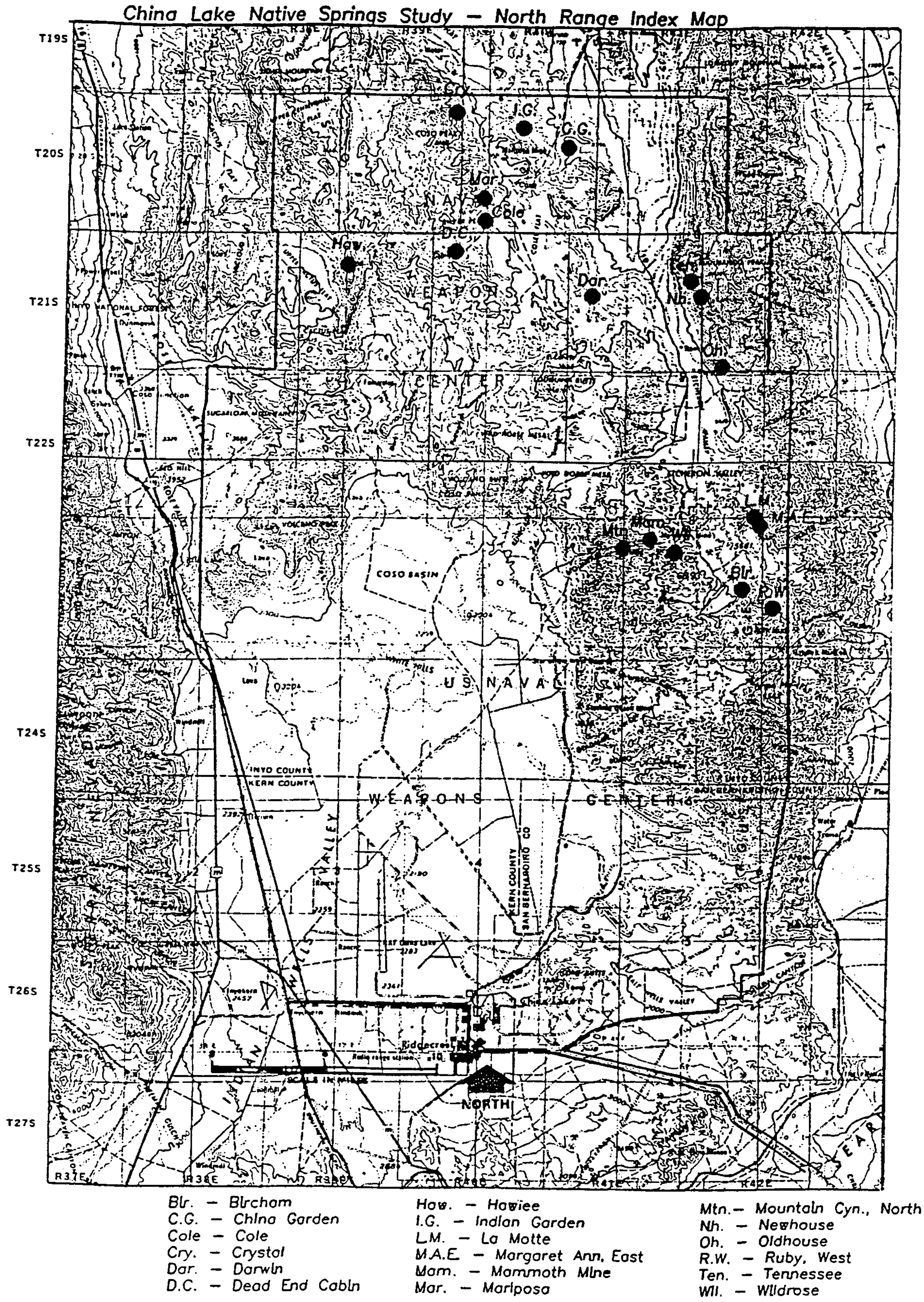


FIGURE 1. China Lake Native Spring Study - North Range Index Map.

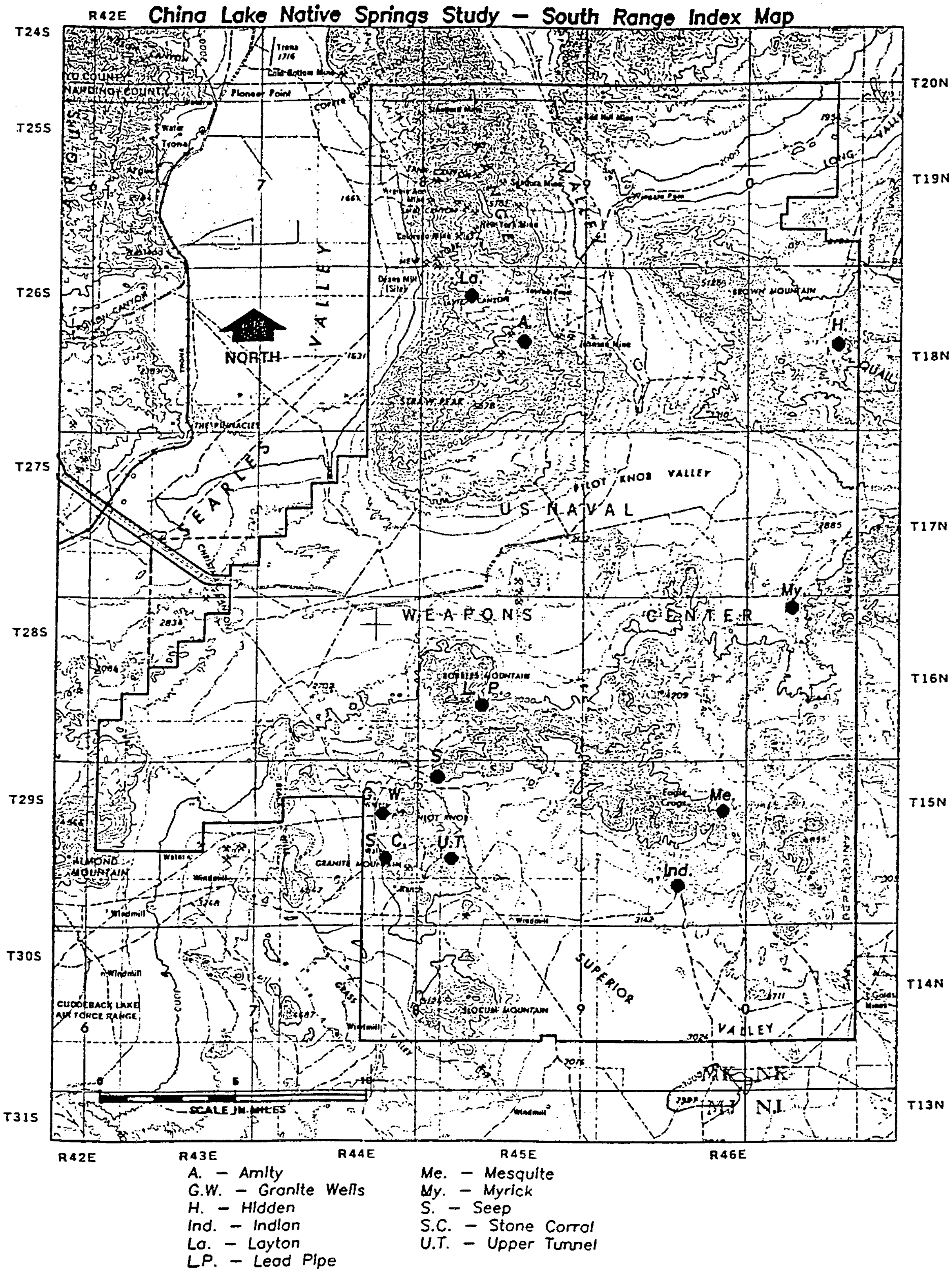


FIGURE 2. China Lake Native Spring Study - South Range Index Map.

TABLE 2. NAWS China Lake Native Spring Study Chemical Analyses.

CHEMICAL ANALYSES

China Lake/NAWS Native Spring Study

Species Analyses	Units	Amity	Bircham	China Garden	Cole	Crystal	Darwin	Dead End	Granite	Haiwee	Hidden
Aluminum (Al)	mg/L	<0.05	<-0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic (As)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012
Barium (Ba)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bicarbonate (HCO3)	mg/L	336	238	107	183	137	183	250	244	153	207
Boron (B)	mg/L	0.3	0.2	0.2	<0.1	<0.1	0.1	0.2	0.3	<0.1	0.4
Bromide (Br)	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L	93	52	49	143	66	83	61	65	33	50
Carbonate (C03)	mg/L	0	0	0	0	0	0	0	0	0	0
Chloride (Cl)	mg/L	75	27	32	38	50	33	23	42	15	51
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride (F)	mg/L	1.1	0.2	0.1	0.2	0.1	0.2	0.3	0.7	0.4	0.8
Hydroxide (OH)	mg/L	0	0	0	0	0	0	0	0	0	0
Iron (Fe)	mg/L	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (Pb)	mg/L	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lithium (Li)	mg/L	0.02	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.03	<0.01	0.03
Magnesium (Mg)	mg/L	31	14	15	46	11	15	12	9	16	16
Manganese (Mn)	mg/L	<0.01	0.02	<0.01	<0.01	0.03	<0.01	0.13	<0.01	<0.01	0.05
MBAS	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate (NO3)	mg/L	24	8	6	4	1	4	<1	37	<1	42
pH - lab	pH units	7.8	8.0	8.0	7.5	7.8	7.8	7.4	7.9	8	7.9
pH - field	pH units	7.5	7.4	7.7	7.2	7.4	7.2	6.8	7.3	7.8	7.4
Potassium (K)	mg/L	3	3	6	4	5	3	2	2	5	7
Selenium (Se)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silica (Si02)	mg/L	36	32	41	30	30	41	36	58	60	73
Silver (Ag)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium (Na)	mg/L	61	28	32	40	18	35	33	59	27	59
Specific Conductance - lab	pmho/cm	880	460	520	1080	520	670	500	680	410	630
Specific Conductance - field	pmho/cm	962	480	493	1155	521	675	537	676	418	678
Sulfate (S04)	mg/L	100	19	120	430	67	140	40	53	63	57
Total Alkalinity as CaCO3	mg/L	275	195	88	150	113	150	205	200	135	170
Total Anions	me/L	10.14	5.20	5.25	13.10	5.08	6.92	5.60	6.92	4.25	6.75
Total Cations	me/L	9.96	5.07	5.24	12.82	5.13	7.00	5.53	6.62	4.28	6.58
Total Chromium (Cr)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Filterable Residue	mg/L	610	295	375	820	315	520	330	440	285	455
Total Hardness as CaCO3	mg/L	362	188	185	549	211	270	203	200	149	192
Zinc (Zn)	mg/L	<0.01	<0.01	<0.01	0.01	<0.01	0.02	0.04	<0.01	<0.01	<0.01
Isotope Analyses											
Tritium	T. units	1.0	<1.7	<0.7	<1.1	<0.7	0.7	1.4	<1.2	1.4	<1.5
Statistical significance		±0.3			App. 0.4		±0.3	±0.4	App. 0.6	±0.4	
Deuterium	%SMOW	-82	-91	-98	-94	-103	-95	-92	-83	-93	-84
Oxygen 18	%SMOW	-11.5	-12.1	-13.0	-12.8	-13.9	-13.2	-12.7	-10.6	-13.2	-9.8

TABLE 2. (Contd.)

CHEMICAL ANALYSES

China Lake NAWS Native Spring Study

Species Analyses	Units	Indian	Indian Garden	La Motte	Layton	Lead Pipe	Mammoth Mine	Margaret Ann - E.	Mariposa	Mesquite	Myrick
Aluminum (Al)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic (As)	mg/L	<0.005	<0.005	<0.005	<0.005	0.018	<0.005	<0.005	0.013	<0.005	0.11
Barium (Ba)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Bicarbonate (HCO3)	mg/L	107	122	290	366	122	302	427	326	153	1530
Boron (B)	mg/L	0.2	0.2	<0.1	2.7	0.3	0.2	0.4	0.1	0.1	3.6
Bromide (Br)	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L	18	68	67	114	26	64	175	255	35	10
Carbonate (C03)	mg/L	0	0	0	0	0	0	0	0	0	78
Chloride (Cl)	mg/L	26	32	36	200	37	40	64	54	26	200
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Fluoride (F)	mg/L	0.3	0.2	0.4	1.6	0.5	0.3	0.8	0.4	0.4	8.2
Hydroxide (OH)	mg/L	0	0	0	0	0	0	0	0	0	0
Iron (Fe)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	1.8
Lead (Pb)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Lithium (Li)	mg/L	0.02	<0.01	<0.01	0.06	0.06	<0.01	0.01	<0.01	0.02	0.11
Magnesium (Mg)	mg/L	9	18	18	40	4	16	45	46	8	3
Manganese (Mn)	mg/L	<0.01	<0.01	0.03	<0.01	<0.01	0.43	<0.01	0.11	<0.01	0.18
MBAS	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate (NO3)	mg/L	22	<1	<1	25	13	<1	<1	<1	29	<1
pH - lab	pH units	7.8	7.8	8.1	7.7	7.7	7.7	7.8	7.4	7.7	8.8
pH - field	pH units	8.1	7.5	8.0	7.4	7.0	7.4	7.7	6.9	7.4	8.4
Potassium (K)	mg/L	7	6	2	2	6	6	4	4	6	24
Selenium (Se)	mg/L	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silica (SiO2)	mg/L	100	36	41	32	103	32	42	64	92	66
Silver (Ag)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium (Na)	mg/L	36	39	38	222	55	47	95	45	36	860
Specific Conductance - lab	pmho/cm	340	670	560	1510	420	600	1400	1530	420	3500
Specific Conductance - field	pmho/cm	362	672	636	1188	449	673	1449	1557	427	3450
Sulfate (S0~)	mg/L	30	190	41	330	46	43	390	560	27	250
Total Alkalinity as CaCO3	mg/L	88	100	238	300	100	248	350	268	125	1390
Total Anions	me/L	3.48	6.87	6.63	18.99	4.24	7.00	16.97	18.56	4.28	38.97
Total Cations	me/L	3.40	6.75	6.55	18.73	4.17	6.72	16.73	18.64	4.14	38.76
Total Chromium (Cr)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Filterable Residue	mg/L	300	500	390	1130	355	395	1010	1360	330	2520
Total Hardness as CaCO3	mg/L	83	245	243	452	82	227	625	829	121	38
Zinc (Zn)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.07
Isotope Analyses											
Tritium	T. units	1.0	<1.1	<1.0	3.1	0.9	<1.1	2.9	0.9	0.8	<0.8
Statistical significance		±0.4	App. 0.4	App. 0.4	±0.4	±0.4	App. 0.4	±0.4	±0.3	±0.4	
Deuterium	%SMOW	-90	-94	-90	-83	-93	-85	-84	-95	-84	-95
Oxygen 18	%SMOW	-12.4	-12.9	-12.0	-10.1	-12.1	-10.8	-11.3	-12.9	-10.5	-11.9

TABLE 2. (Contd.)

CHEMICAL ANALYSES

China Lake NAWS Native Spring Study

Species Analyses	Units	New House	North Mountain	Old House	Pink Hill	Ruby - west	Seep	Stone Corral	Tennessee	Upper Tunnel
Aluminum (Al)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic (As)	mg/L	<0.005	<0.005	<0.005	0.006	<0.005	0.016	<0.005	<0.005	<0.005
Barium (Ba)	mg/L	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1
Bicarbonate (HCO3)	mg/L	137	439	183	174	357	76	195	153	183
Boron (B)	mg/L	<0.1	0.6	<0.1	0.3	0.3	0.3	0.2	<0.1	0.1
Bromide (Br)	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	mg/L	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L	44	113	59	3	86	21	69	51	72
Carbonate (C03)	mg/L	0	0	0	0	0	0	0	0	0
Chloride (Cl)	mg/L	14	93	16	37	56	24	33	26	41
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride (F)	mg/L	<0.1	0.4	0.1	0.4	0.2	0.5	0.6	0.2	0.6
Hydroxide (OH)	mg/L	0	0	0	0	0	0	0	0	0
Iron (Fe)	mg/L	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (Pb)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lithium (Li)	mg/L	<0.01	<0.01	<0.01	0.09	<0.01	0.02	0.01	<0.01	0.02
Magnesium (Mg)	mg/L	4	30	9	<1	17	4	8	5	11
Manganese (Mn)	mg/L	<0.01	0.22	<0.01	0.01	0.06	<0.01	<0.01	<0.01	<0.01
MBAS	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate (NO3)	mg/L	2	<1	<1	19	<1	16	46	<1	54
pH - lab	pH units	8.1	7.7	8.2	8.1	7.4	8.1	8.0	8.0	7.9
pH - field	pH units	7.6	7.3	7.8	7.3	7.3	7.7	7.4	7.7	7.5
Potassium (K)	mg/L	2	8	1	4	2	6	<1	3	2
Selenium (Se)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silica (Si02)	mg/L	21	47	24	64	55	109	45	24	32
Silver (Ag)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium (Na)	mg/L	17	83	19	112	47	37	40	24	43
Specific Conductance - lab	pmho/cm	330	1040	440	480	720	340	600	420	670
Specific Conductance - field	pmho/cm	354	1128	443	520	157	346	614	427	667
Sulfate (S0~)	mg/L	35	110	54	39	19	44	61	51	76
Total Alkalinity as CaCO3	mg/L	113	360	150	143	293	63	160	125	150
Total Anions	me/L	3.40	12.13	4.58	5.03	7.84	3.14	6.17	4.30	6.63
Total Cations	me/L	3.32	11.97	4.56	5.12	7.81	3.14	5.86	4.09	6.44
Total Chromium (Cr)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Filterable Residue	mg/L	210	750	275	355	450	305	395	260	415
Total Hardness as CaCO3	mg/L	127	408	185	8	286	69	206	148	226
Zinc (Zn)	mg/L	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.030
Isotope Analyses										
Tritium	T. units	<0.7	1.4	<1.3	<0.7	<1.4	<1.1	<1.8	<1.1	0.9
Statistical significance			±0.3	App. 0.6		App. 0.6	App. 0.4	App. 0.9	App. 0.5	±0.4
Deuterium	%SMOW	-97	-85	-92	-89	-88	-86	-82	-97	-76
Oxygen 18	%SMOW	-13.3	-11.9	-13.0	-11.8	-12.3	-11.6	-11.2	-13.6	-8.9

TABLE 2. (Contd.)

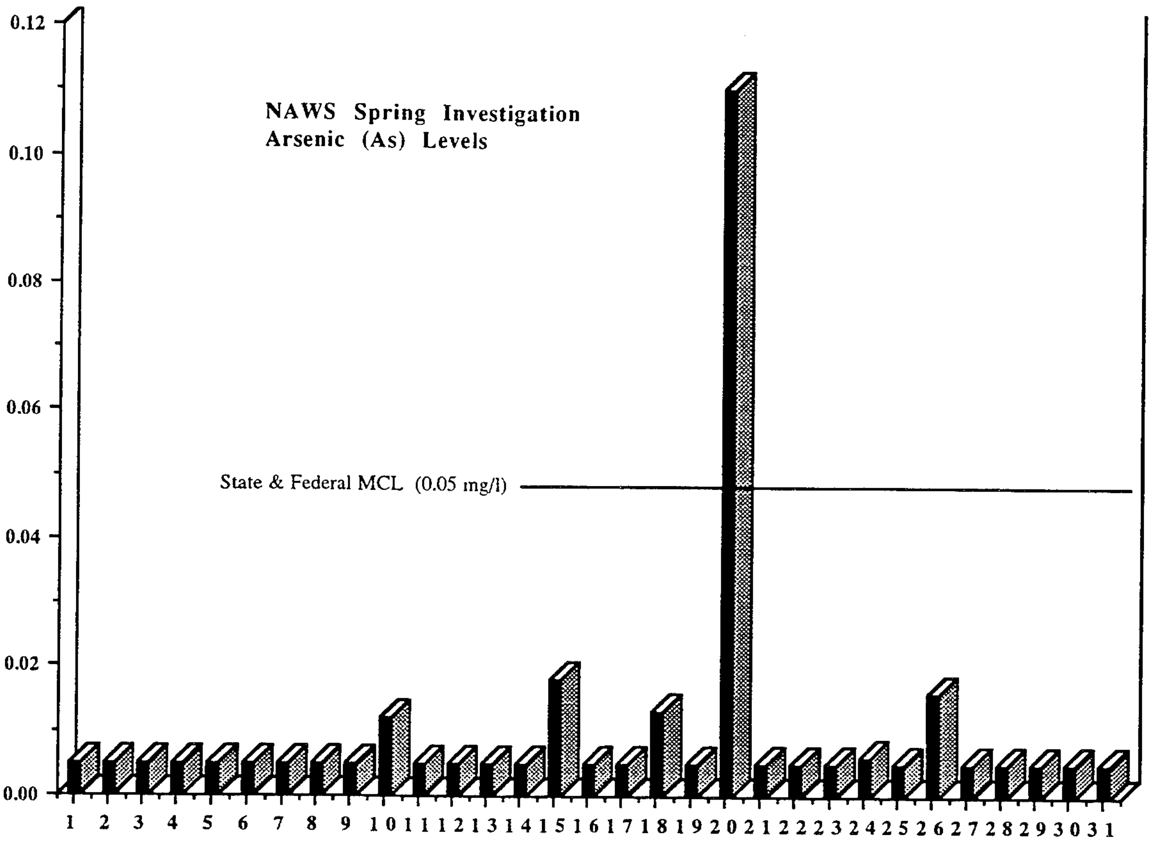
China Lake NAWS Native Spring Study

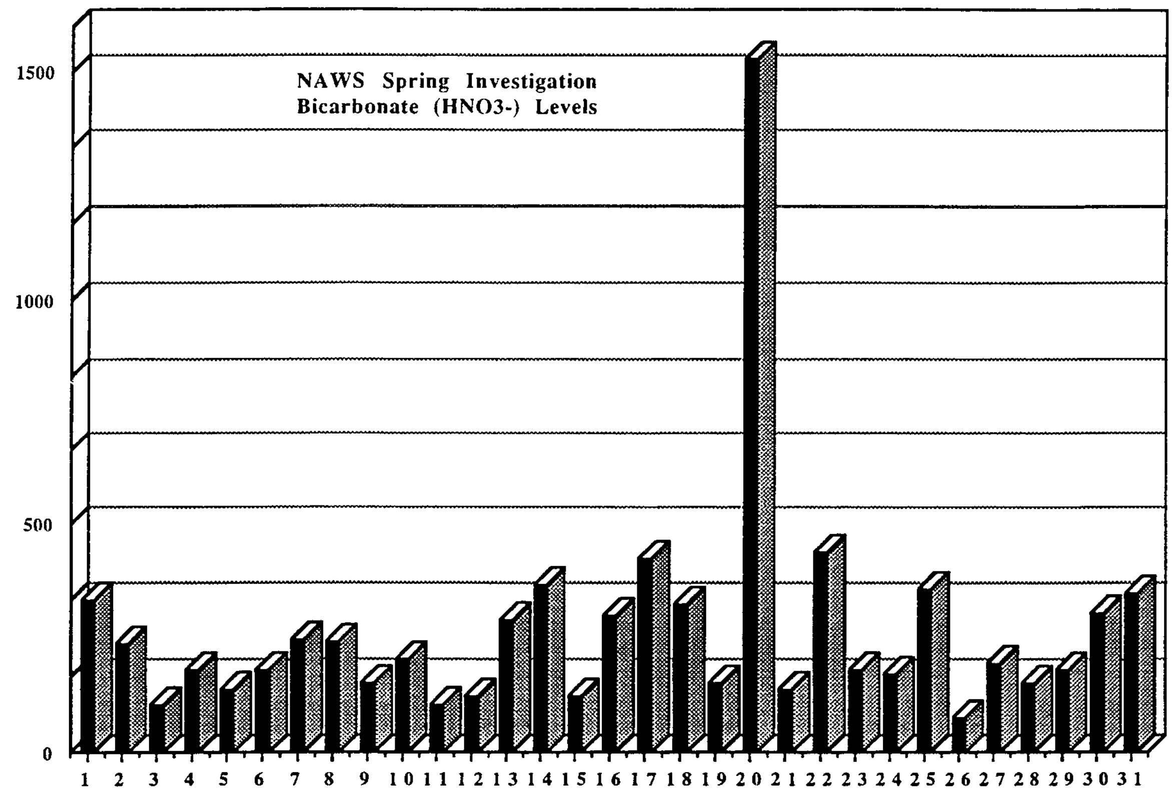
CHEMICAL ANALYSES

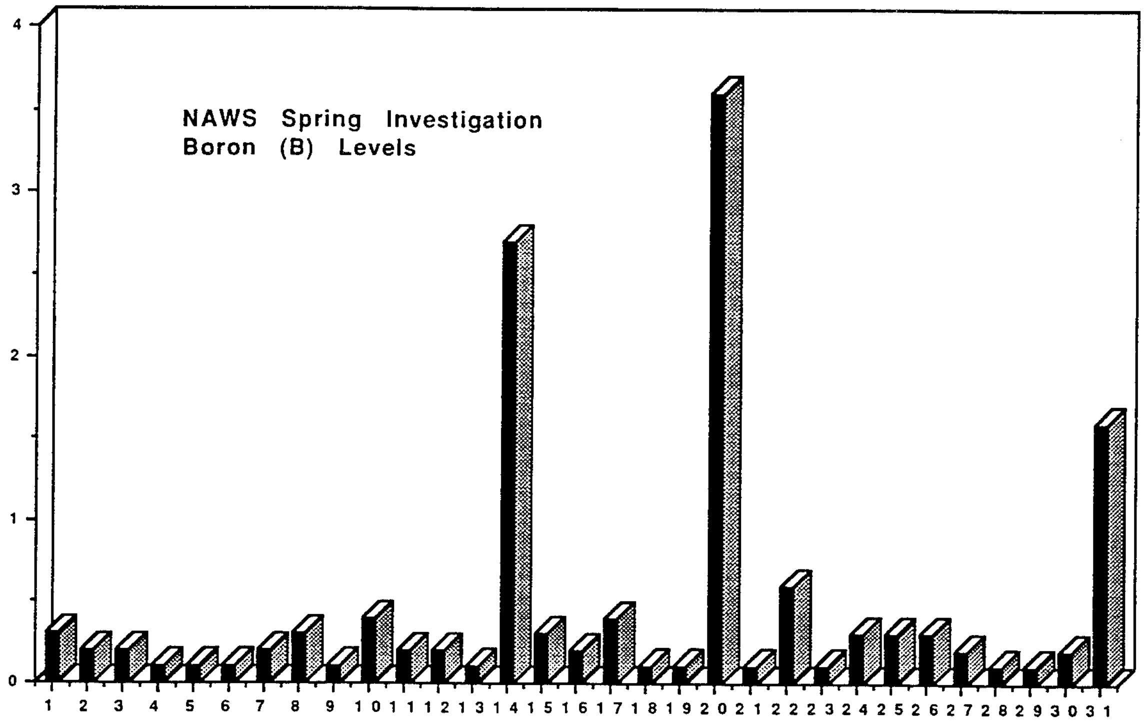
Species Analyses	Units	Wildrose Mine	Wilson
Aluminum (Al)	mg/L	<0.05	<0.05
Arsenic (As)	mg/L	<0.005	<0.005
Barium (Ba)	mg/L	<0.1	<0.1
Bicarbonate (HCO3)	mg/L	305	348
Boron (B)	mg/L	0.2	1.6
Bromide (Br)	mg/L	<1	<1
Cadmium (Cd)	mg/L	<0.001	<0.001
Calcium (Ca)	mg/L	78	112
Carbonate (C03)	mg/L	0	0
Chloride (Cl)	mg/L	42	260
Copper (Cu)	mg/L	<0.01	<0.01
Fluoride (F)	mg/L	0.3	0.6
Hydroxide (OH)	mg/L	0	0
Iron (Fe)	mg/L	<0.02	<0.02
Lead (Pb)	mg/L	<0.005	<0.005
Lithium (Li)	mg/L	<0.01	<0.01
Magnesium (Mg)	mg/L	18	43
Manganese (Mn)	mg/L	0.02	<0.01
MBAS	mg/L	<0.05	<0.05
Mercury (Hg)	mg/L	<0.001	<0.001
Nitrate (NO3)	mg/L	2	4
pH - lab	pH units	7.9	8.1
pH - field	pH units	7.3	8.0
Potassium (K)	mg/L	2	6
Selenium (Se)	mg/L	<0.005	<0.005
Silica (Si02)	mg/L	36	49
Silver (Ag)	mg/L	<0.01	<0.01
Sodium (Na)	mg/L	35	160
Specific Conductance - lab	pmho/cm	520	1450
Specific Conductance - field	pmho/cm	670	1600
Sulfate (S0~)	mg/L	43	160
Total Alkalinity as CaCO3	mg/L	250	285
Total Anions	me/L	7.13	16.44
Total Cations	me/L	6.97	16.28
Total Chromium (Cr)	mg/L	<0.01	<0.01
Total Filterable Residue	mg/L	385	1080
Total Hardness as CaCO3	mg/L	270	459
Zinc (Zn)	mg/L	<0.01	<0.01
Isotope Analyses			
Tritium	T. units	1.7	1.8
		±0.5	±0.4
Deuterium	%SMOW	-92	-85
Oxygen 18	%SMOW	-12.5	-10.7

Appendix A

WATER CHEMISTRY GRAPHICS


NAWS Spring Investigation
Arsenic (As) Levels
State & Federal MCL (0.05 mg/l)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


NAWS Spring Investigation
Bicarbonate (HNO3-) Levels
1500
1000
500
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


NAWS Spring Investigation
Boron (B) Levels
0
1
2
3
4
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
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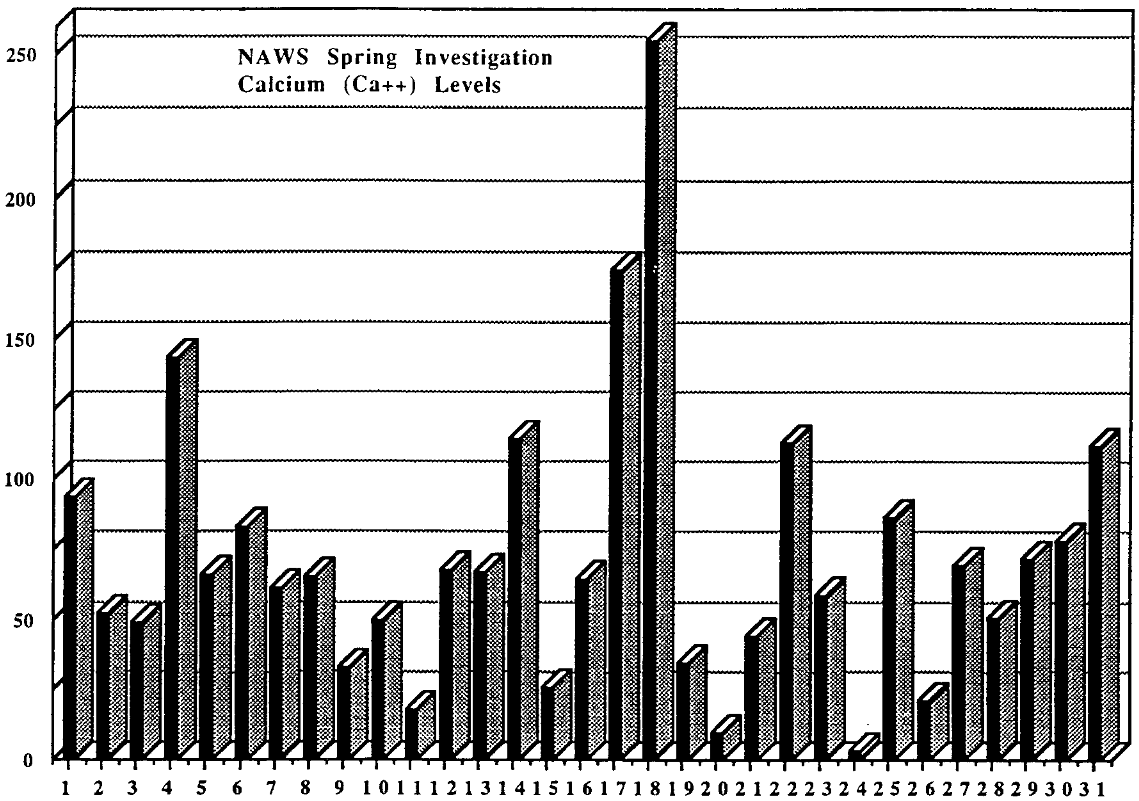
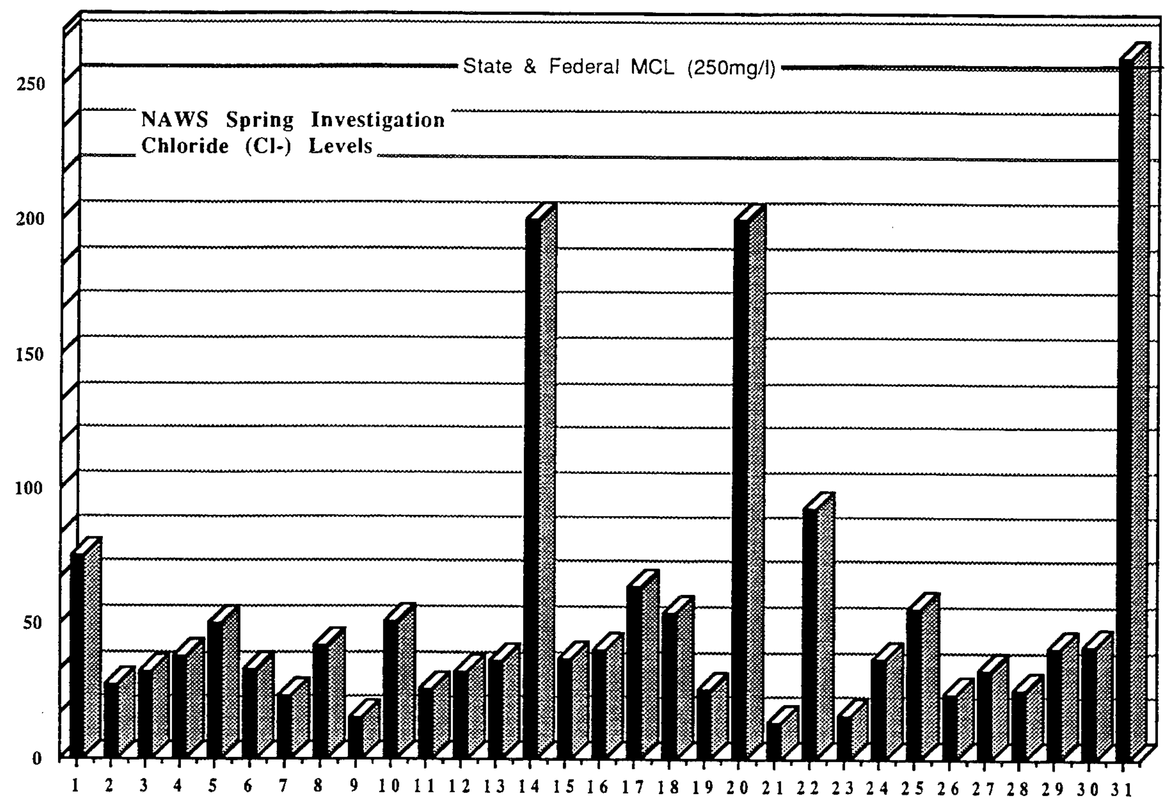
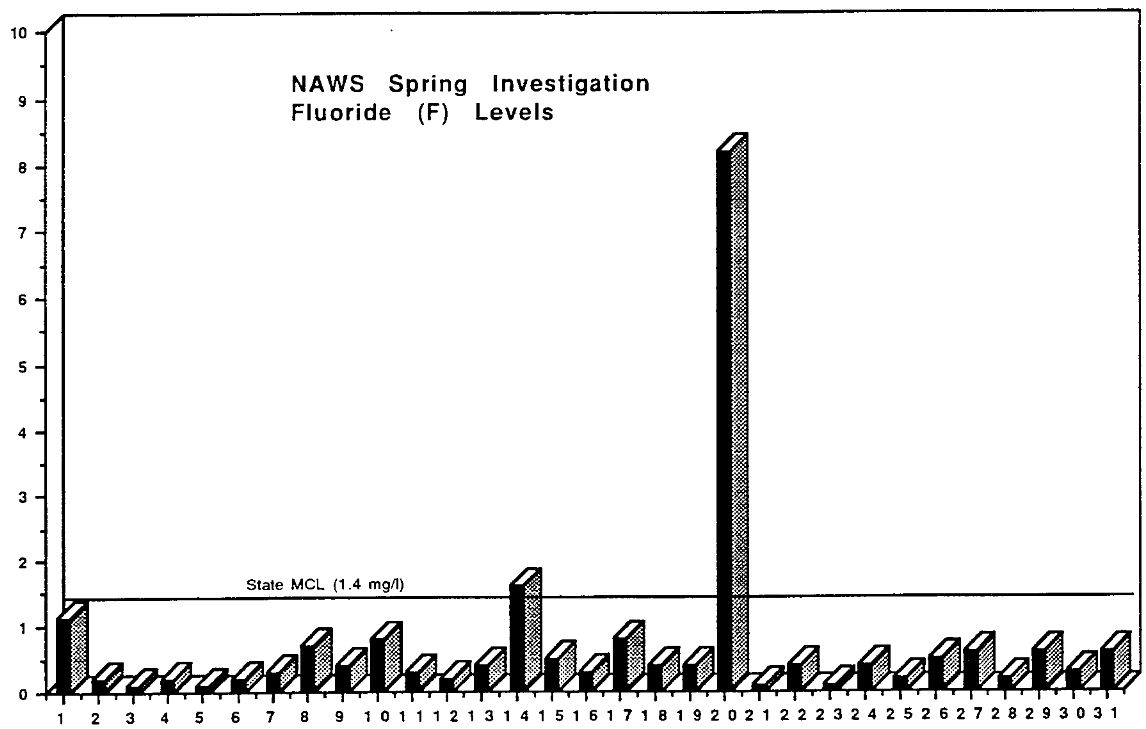
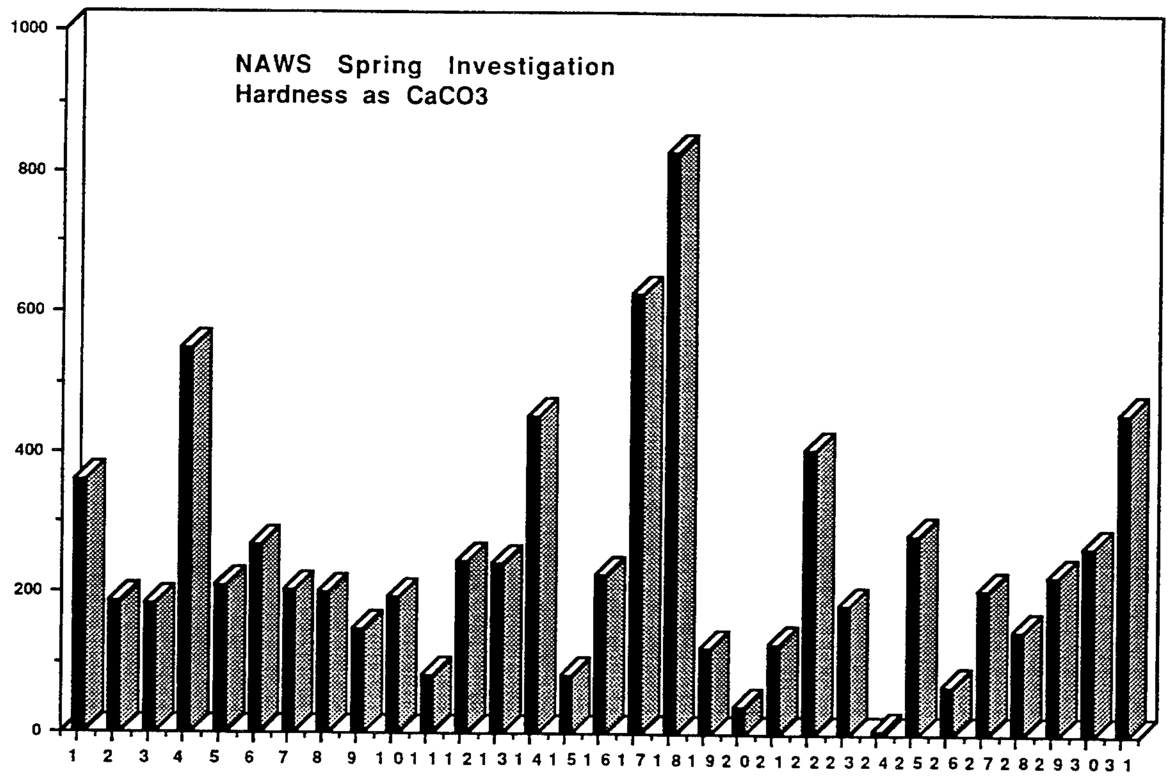
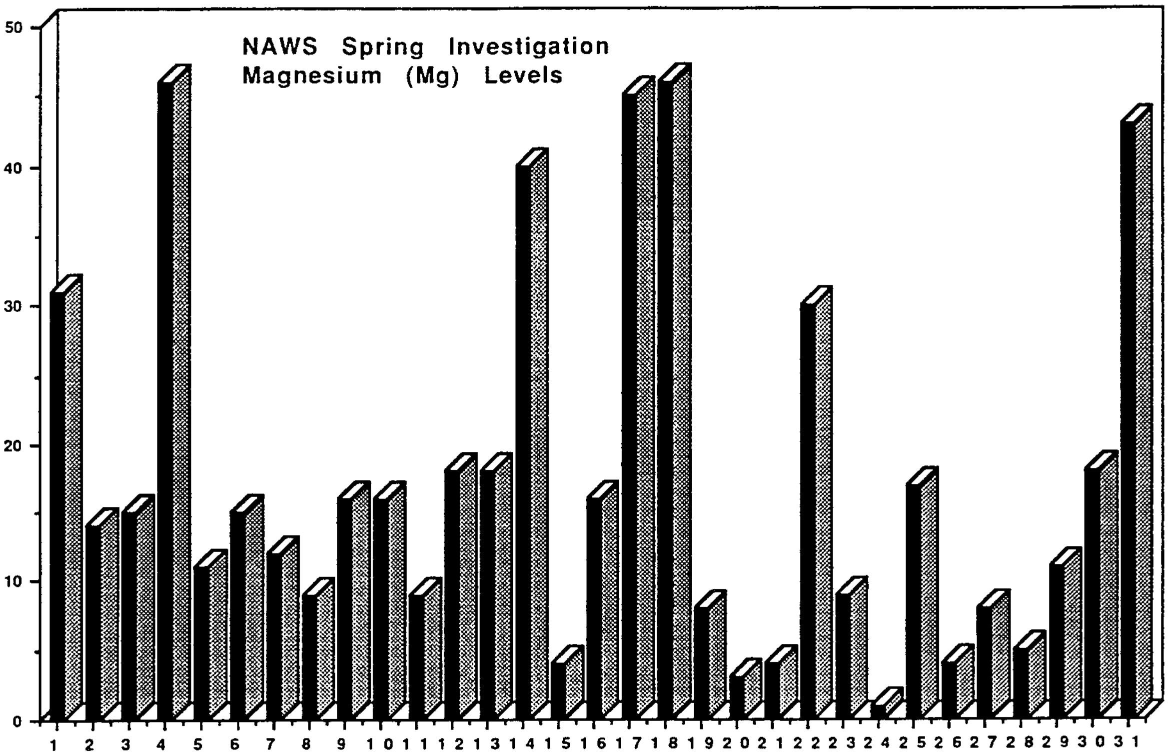
27
28
29
30
31

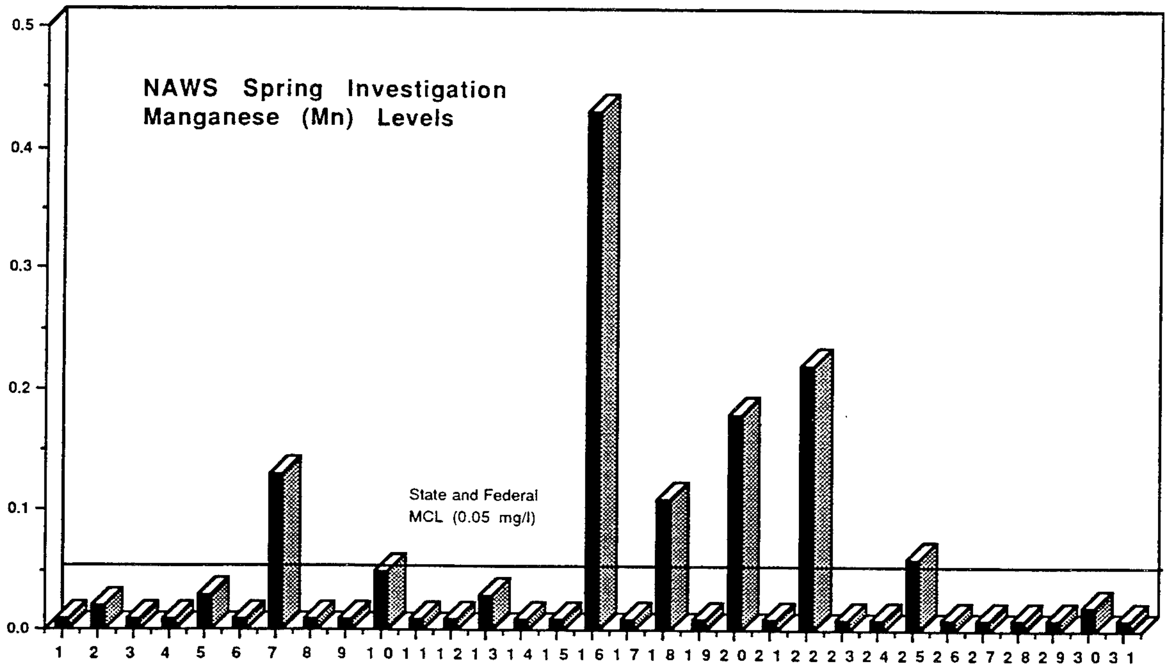

NAWS Spring Investigation
Calcium (Ca++) Levels
250
200
150
100
50
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

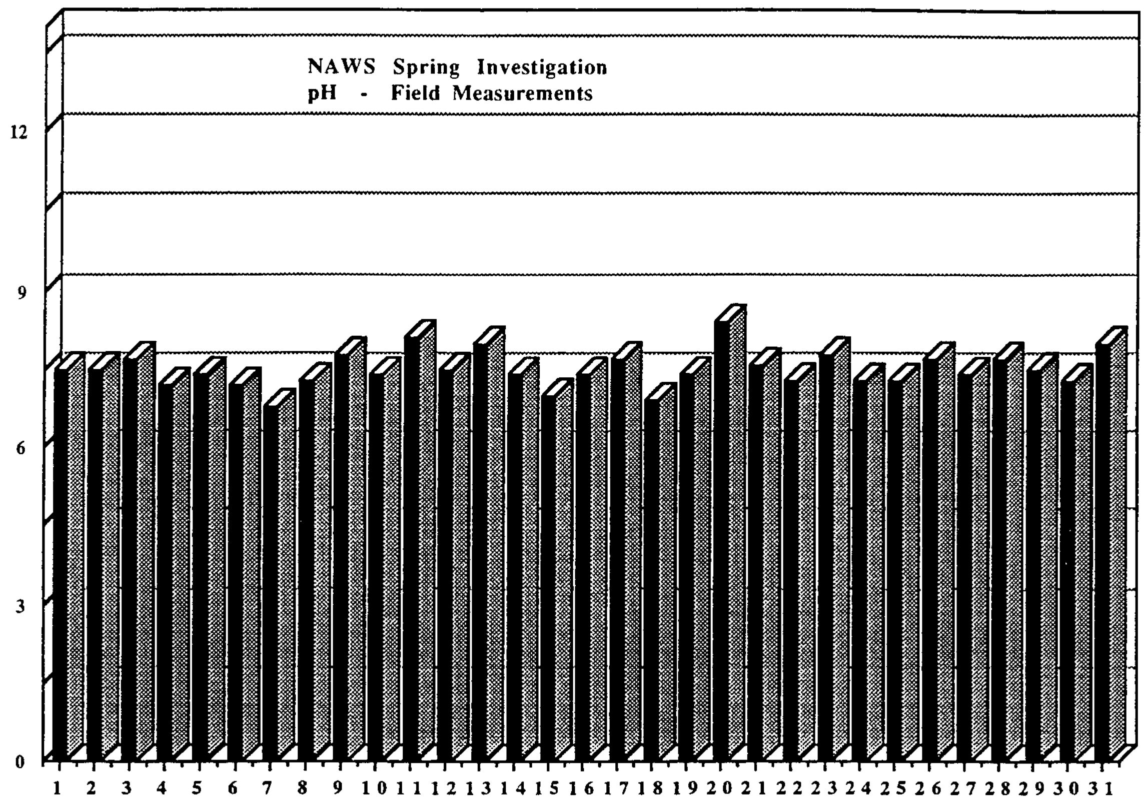

State & Federal MCL (250mg/l)
NAWS Spring Investigation
Chloride (Cl-) Levels
0
50
100
150
200
250
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

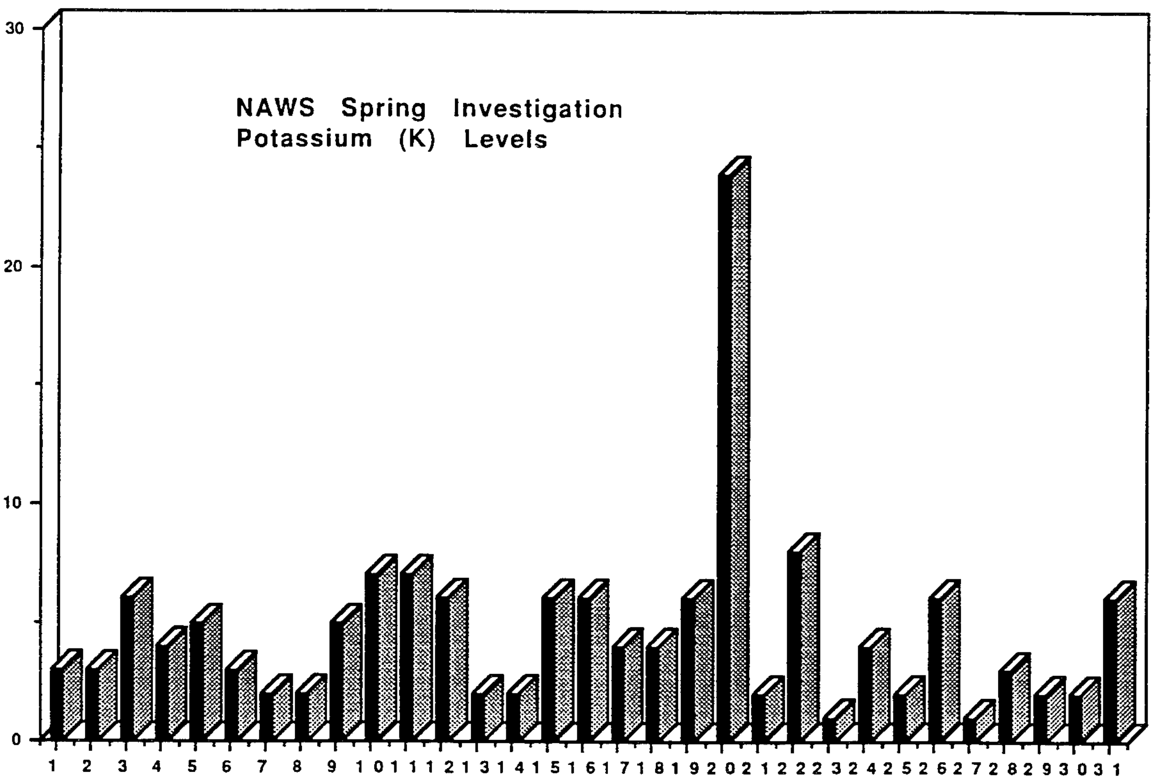

NAWS Spring Investigation
Fluoride (F) Levels
State MCL (1.4 mg/l)
10
9
8
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

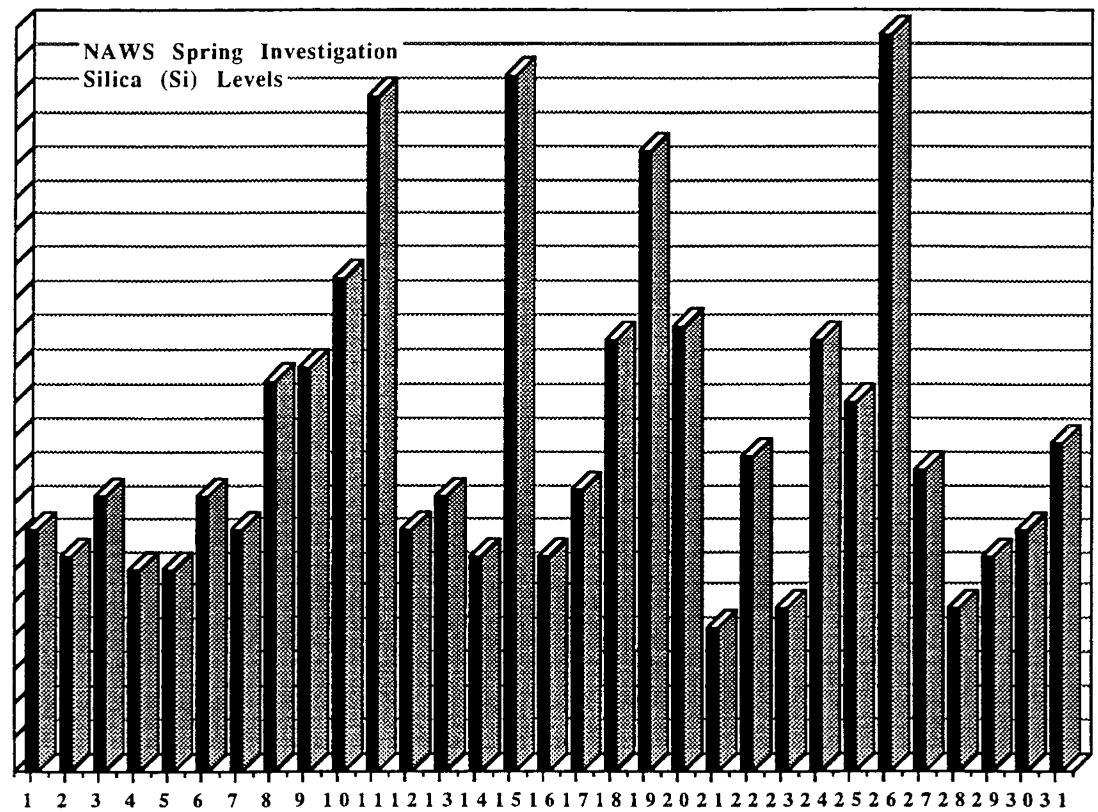

NAWS Spring Investigation
Hardness as CaCO3
1000
800
600
400
200
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

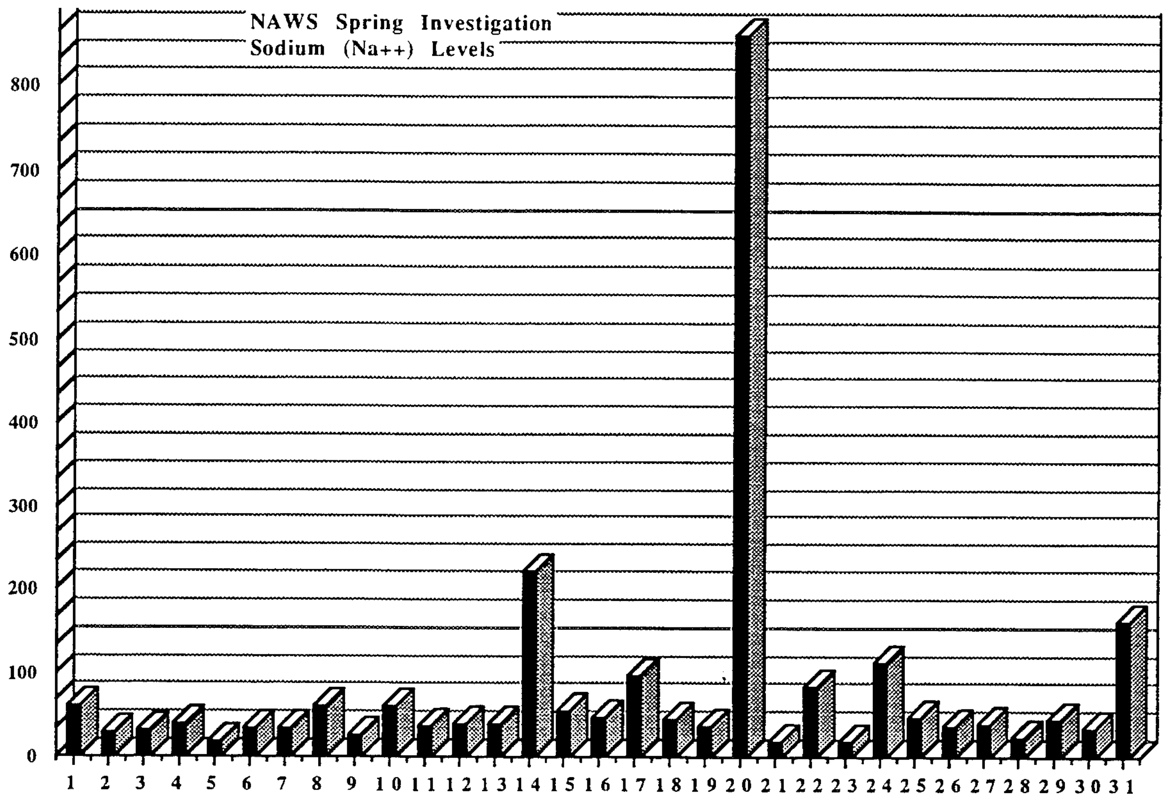

NAWS Spring Investigation
Magnesium (Mg) Levels
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

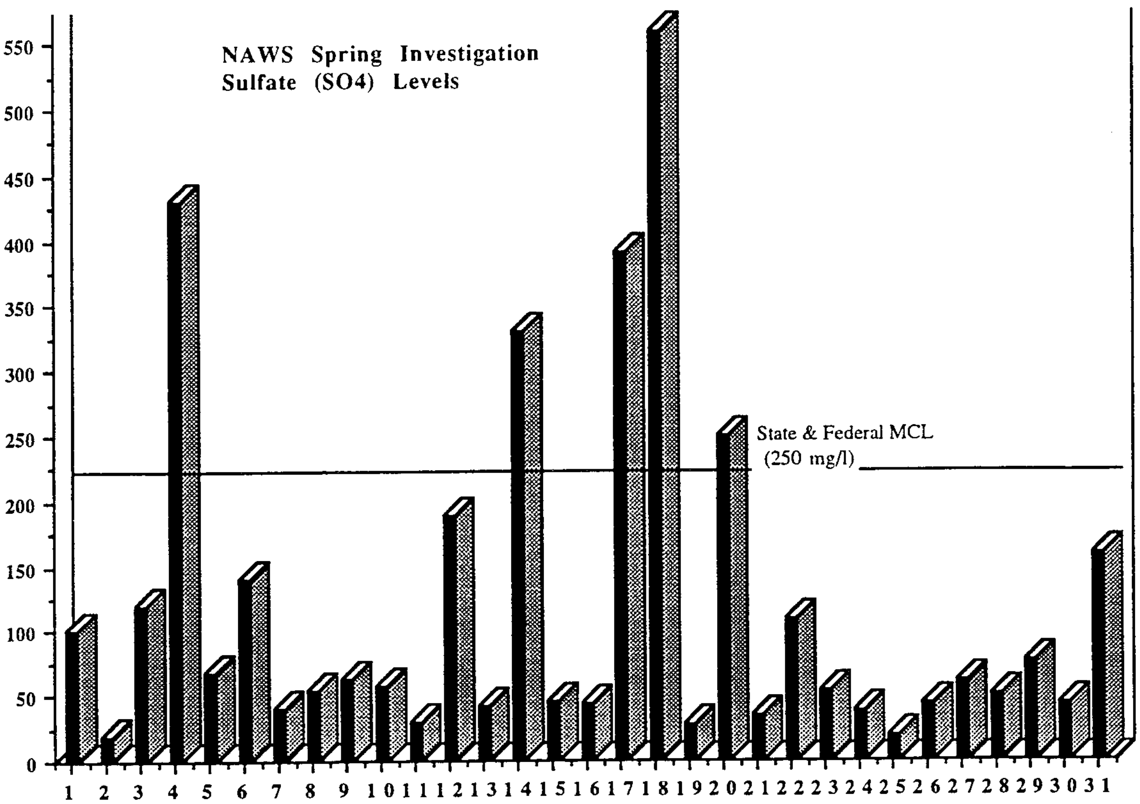

NAWS Spring Investigation
Manganese (Mn) Levels
State and Federal
MCL (0.05 mg/l)
0.5
0.4
0.3
0.2
0.1
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

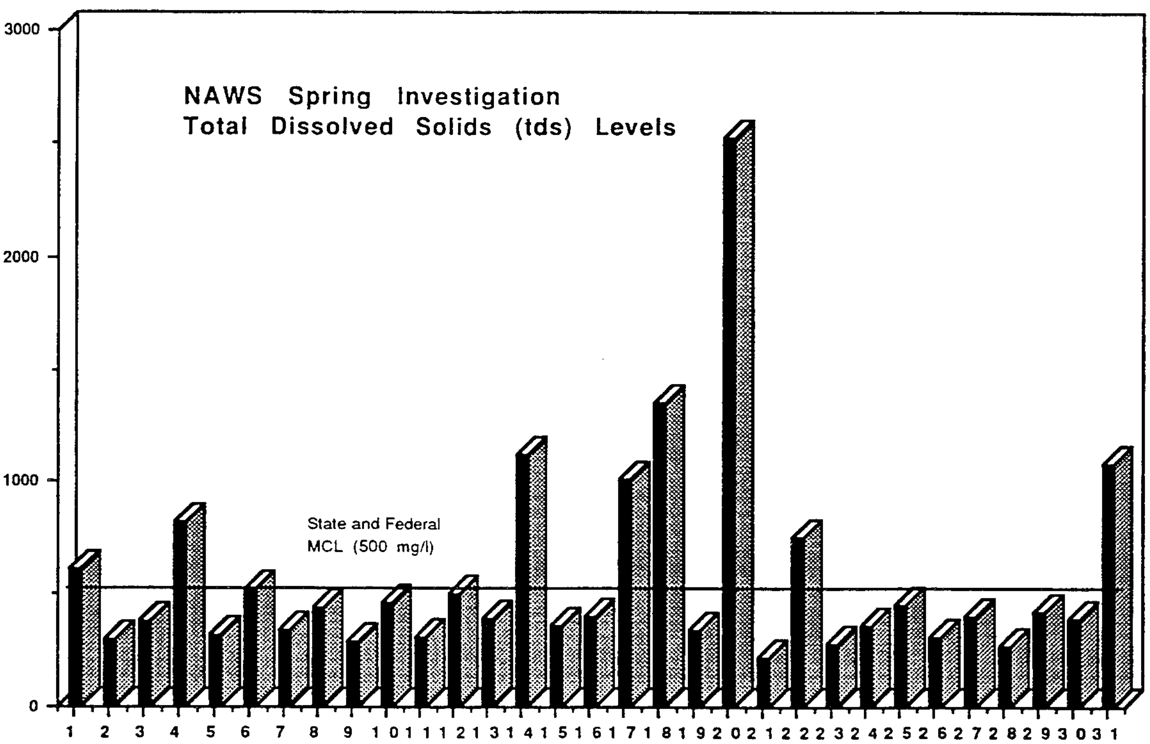

NAWS Spring Investigation
pH - Field Measurements
12
9
6
3
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

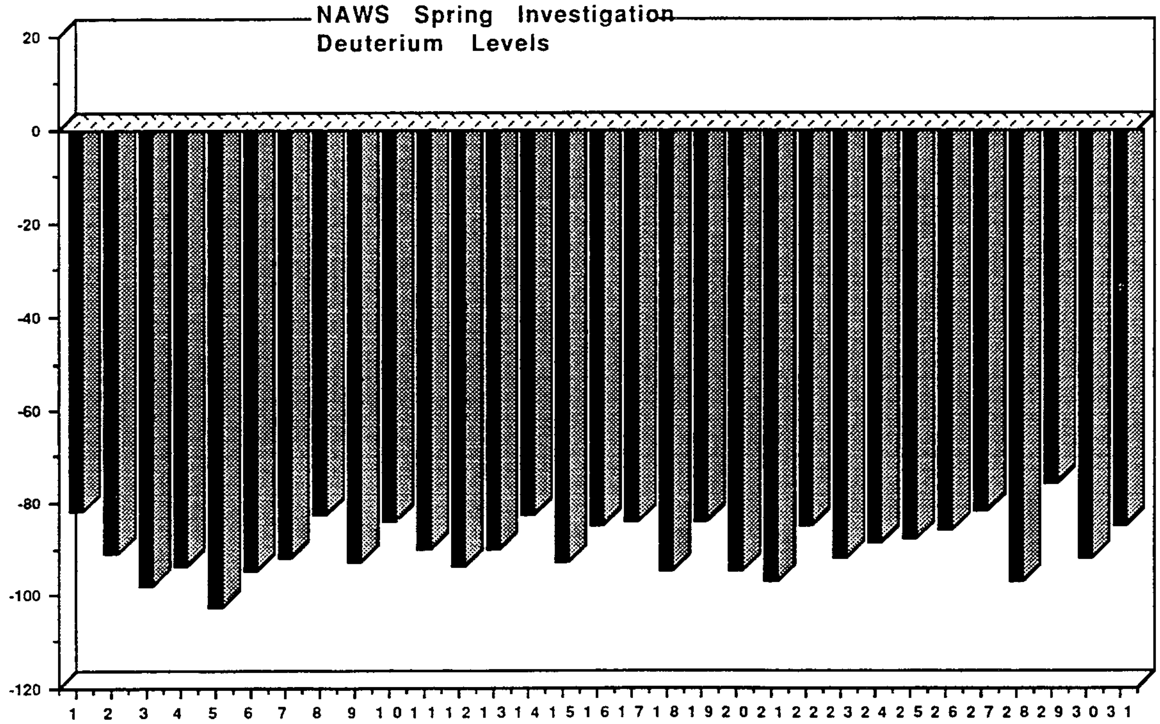

30
20
10
0
NAWS Spring Investigation
Potassium (K) Levels
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

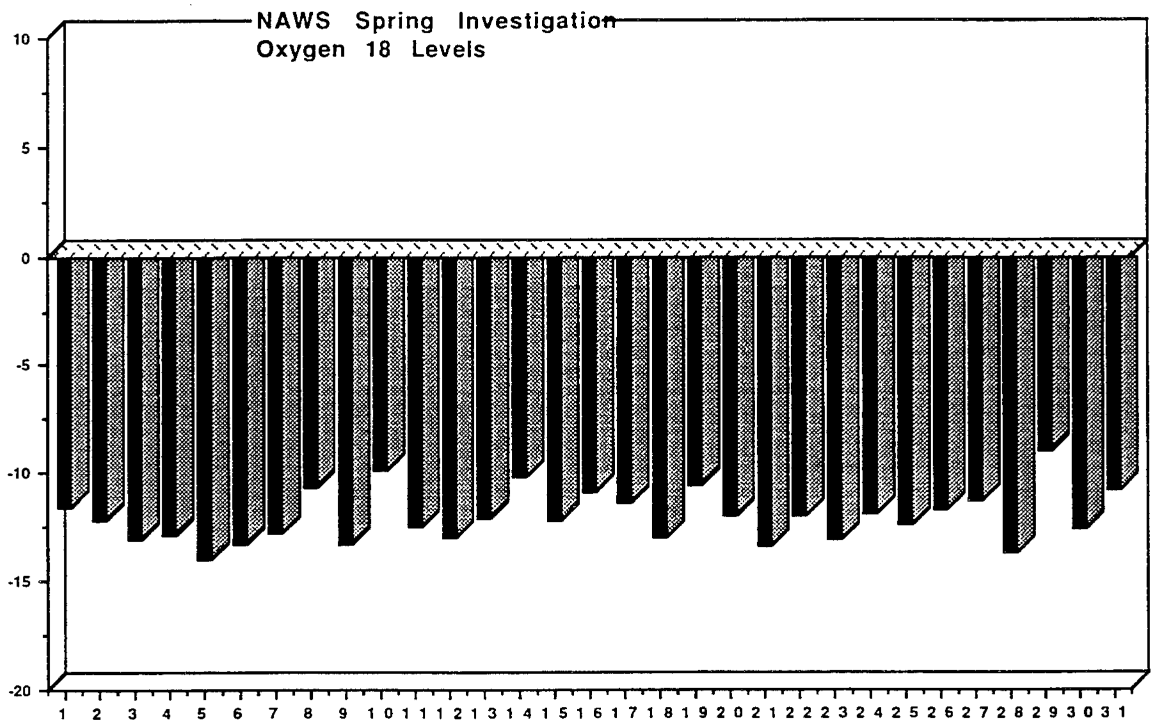

NAWS Spring Investigation
Silica (Si) Levels
110
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

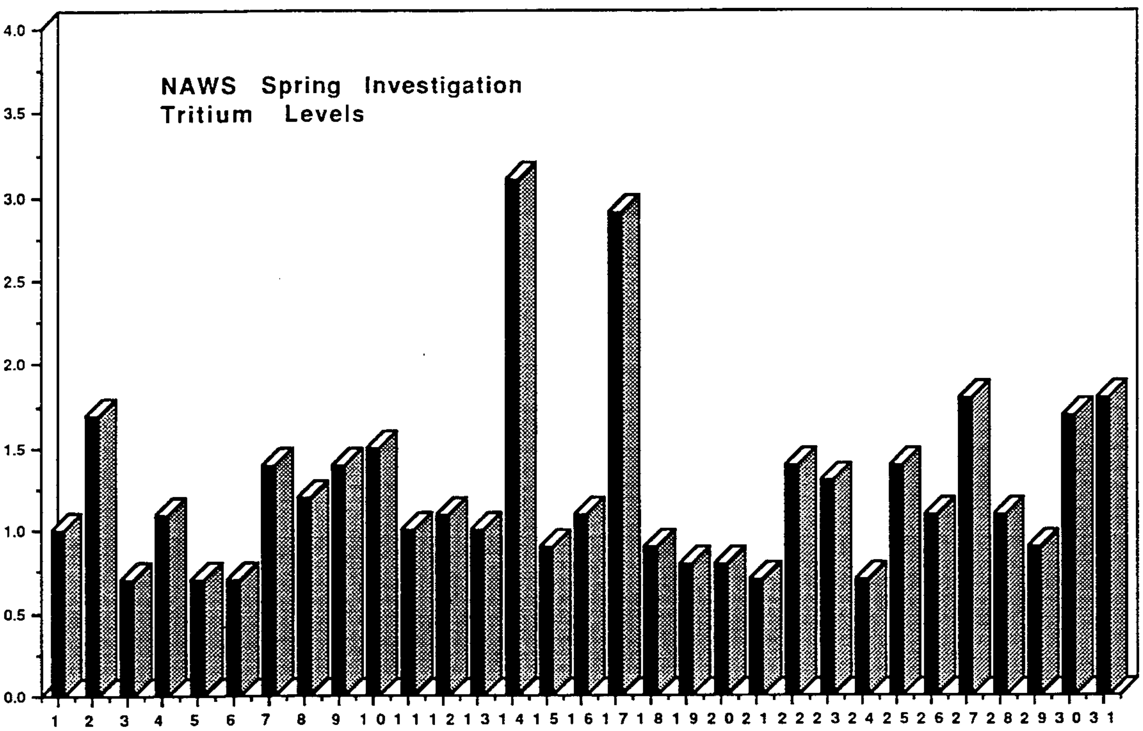

NAWS Spring Investigation
Sodium (Na++) Levels
800
700
600
500
400
300
200
100
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


NAWS Spring Investigation
Sulfate (SO4) Levels
State & Federal MCL
(250 mg/l)
0
50
100
150
200
250
300
350
400
450
500
550
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


NAWS Spring Investigation
Total Dissolved Solids (tds) Levels
State and Federal
MCL (500 mg/l)
3000
2000
1000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

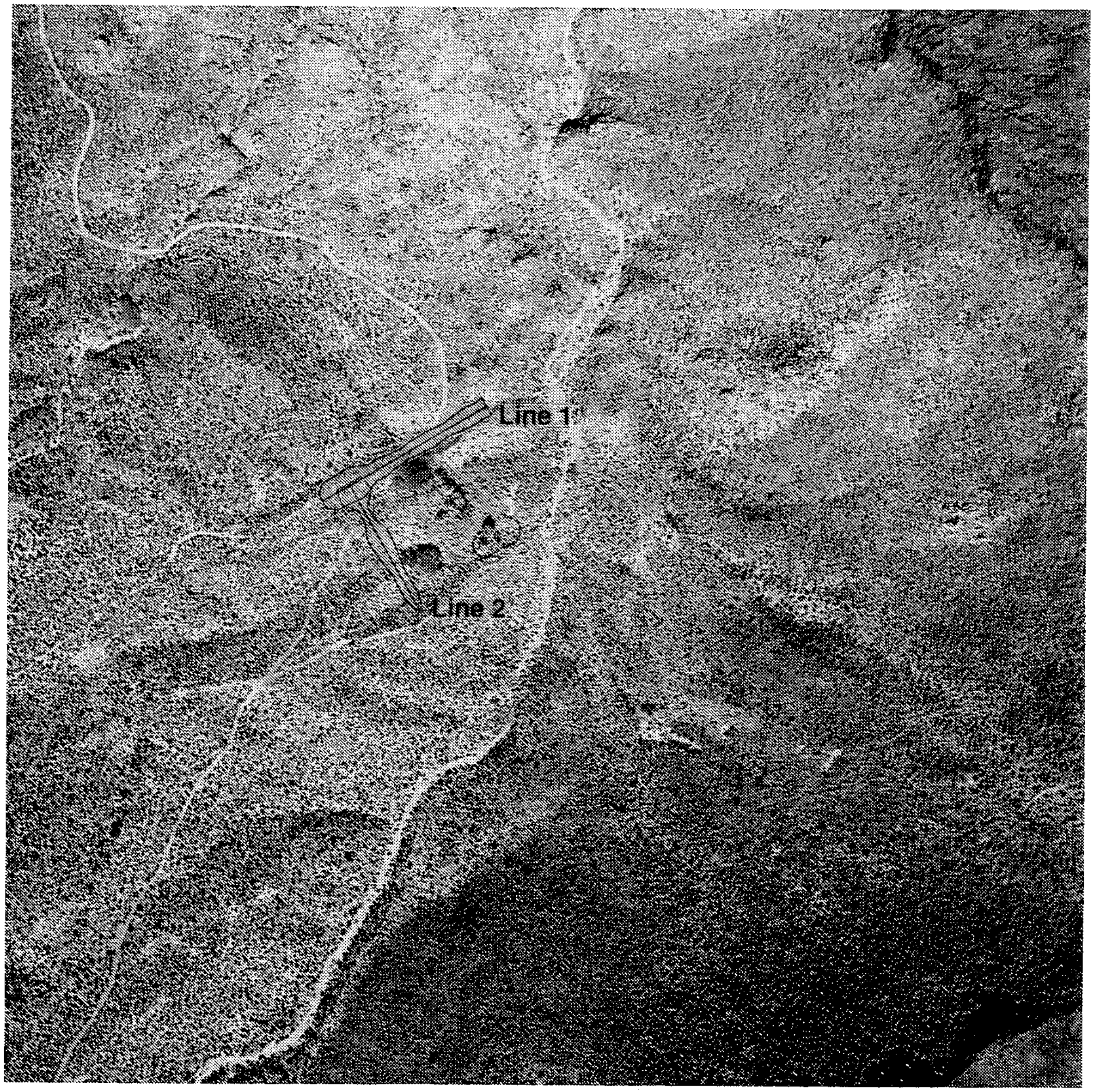

NAWS Spring Investigation
Deuterium Levels
20
0
-20
-40
-60
-80
-100
-120
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

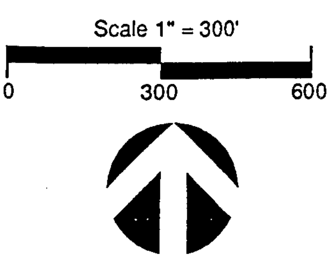

NAWS Spring Investigation
Oxygen 18 Levels
10
5
0
-5
-10
-15
-20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


NAWS Spring Investigation
Tritium Levels
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

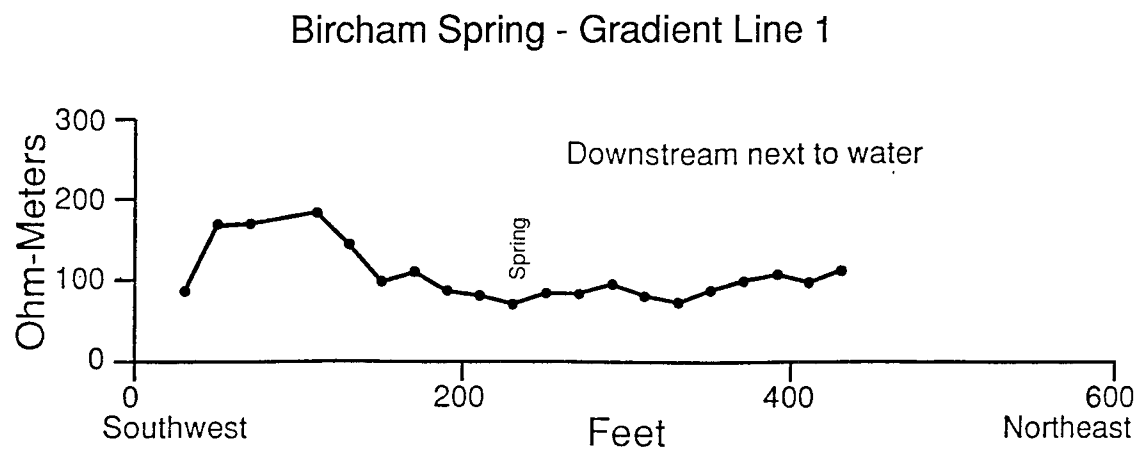
Appendix B

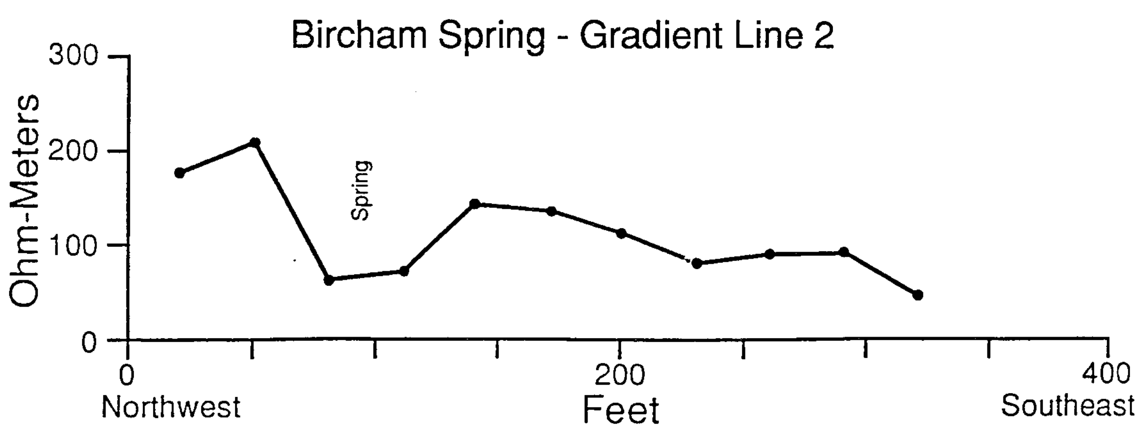
SPRING RESISTIVITY SURVEYS



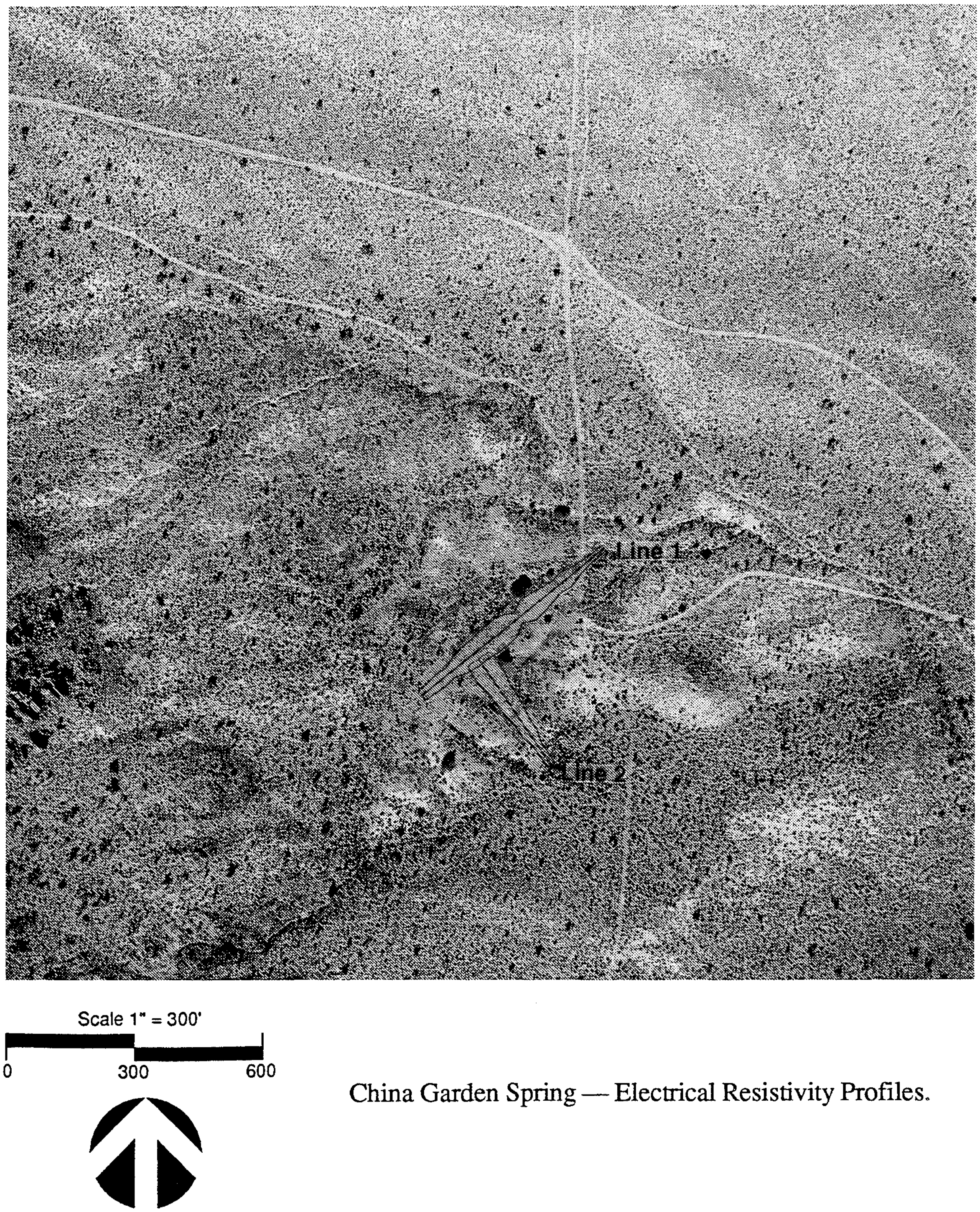


Bircham Spring — Electrical Resistivity Profiles.

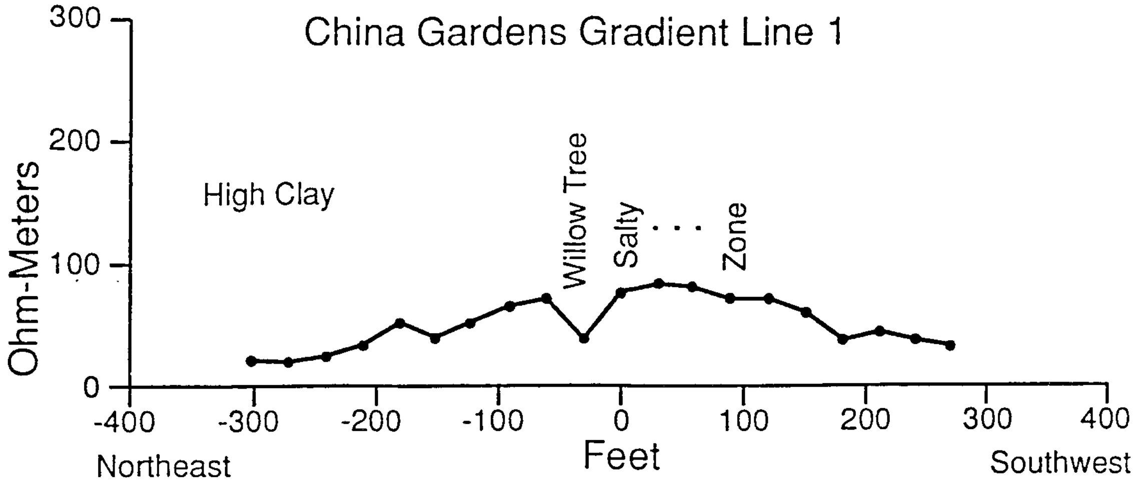


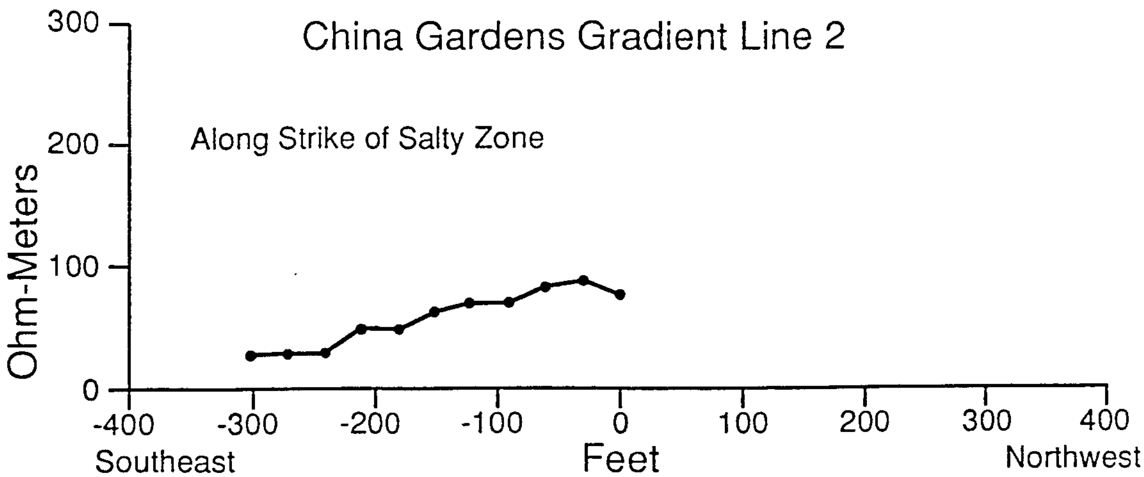


Bircham Spring — Electrical Resistivity Profiles.

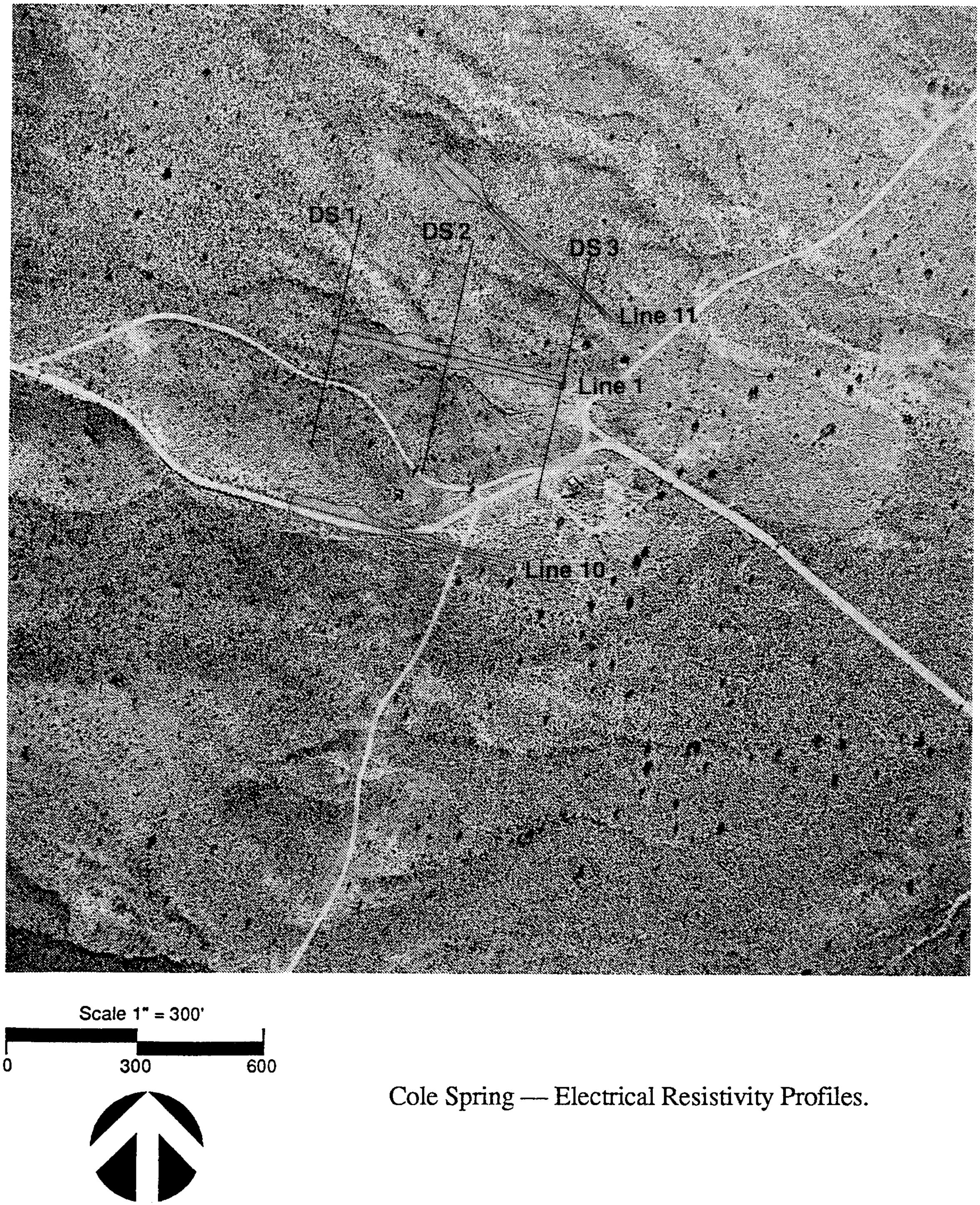


China Garden Spring — Electrical Resistivity Profiles.

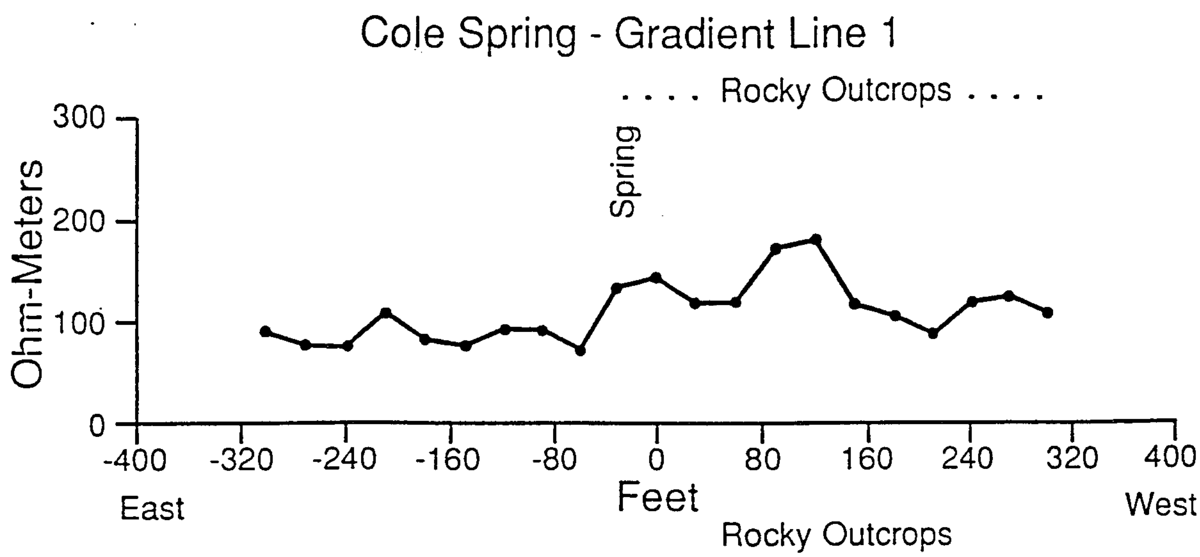




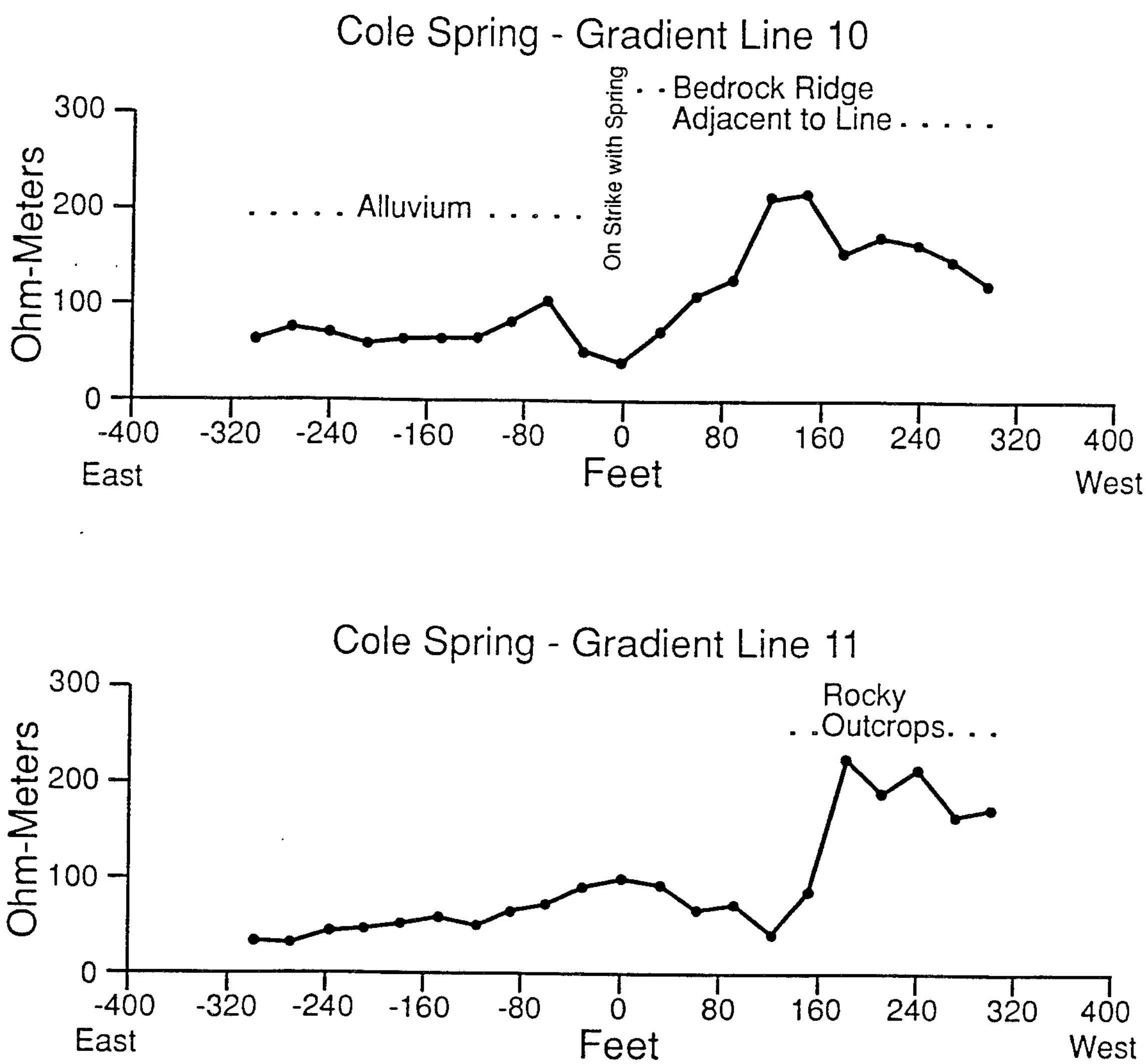
China Garden Spring — Electrical Resistivity Profiles.



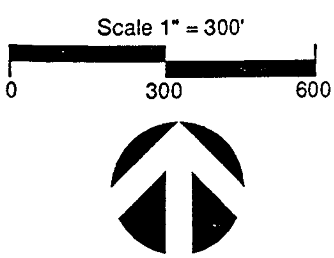
Cole Spring — Electrical Resistivity Profiles.



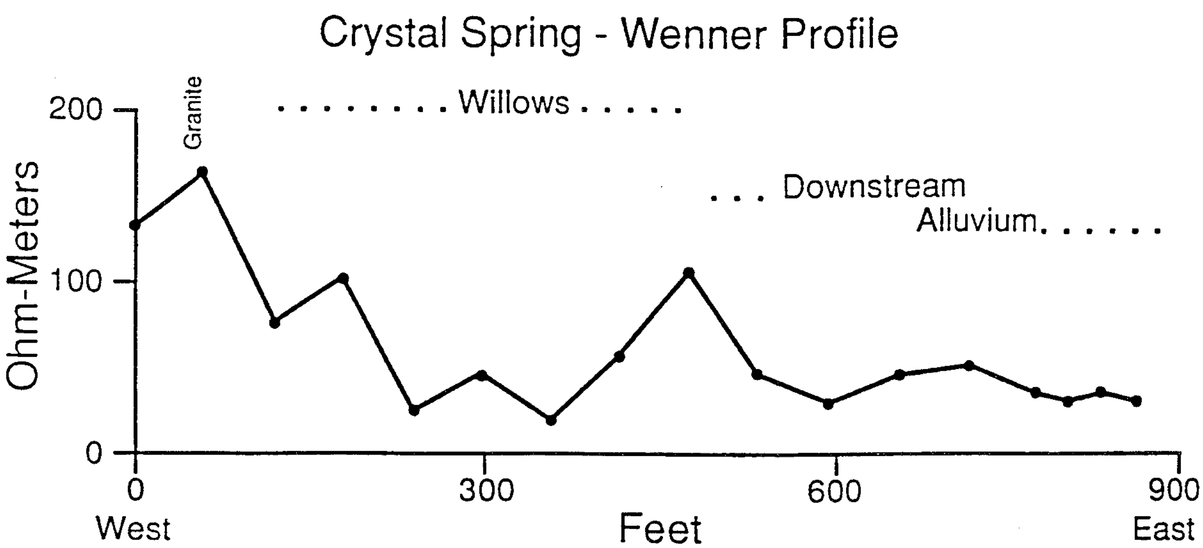
Cole Spring — Electrical Resistivity Profiles.



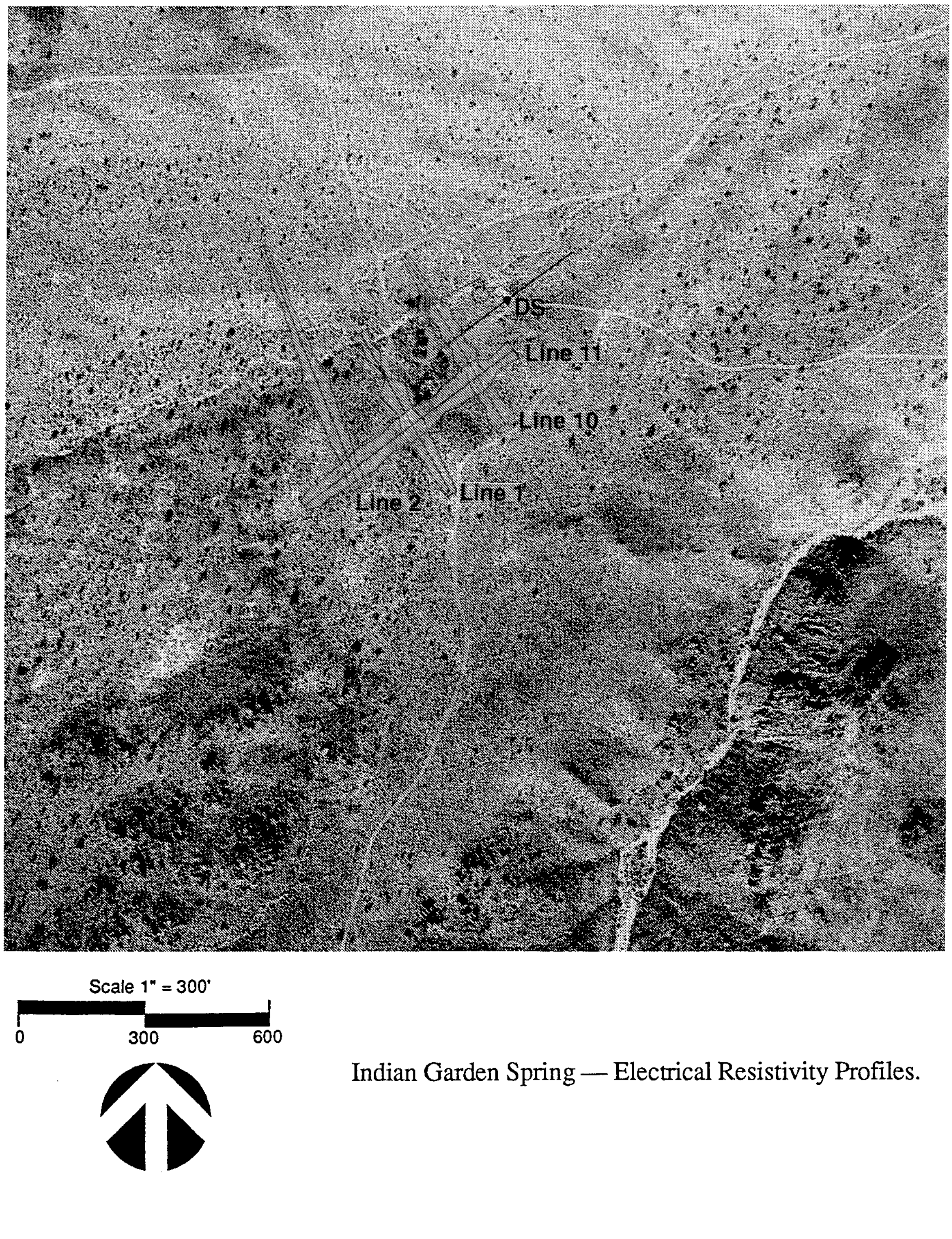
Cole Spring — Electrical Resistivity Profiles.



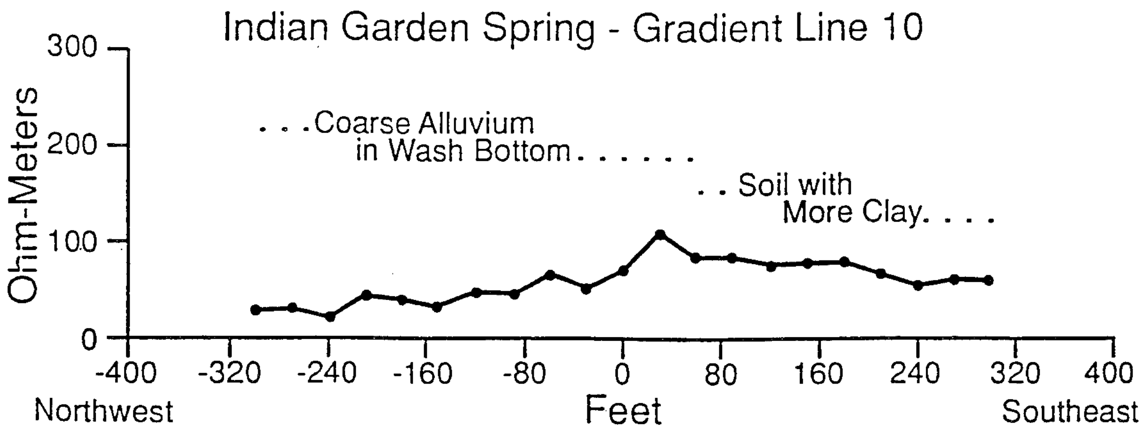
Crystal Spring — Electrical Resistivity Profiles.

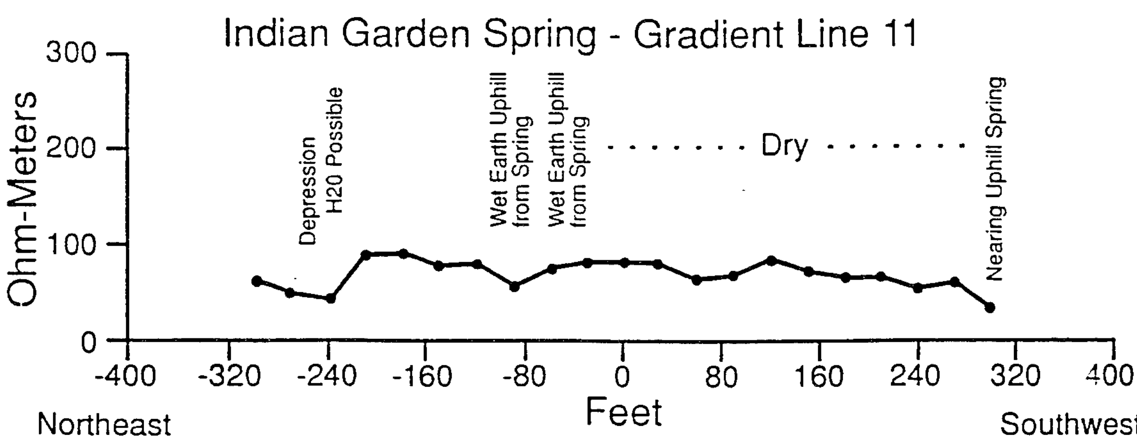


Crystal Spring — Electrical Resistivity Profiles.

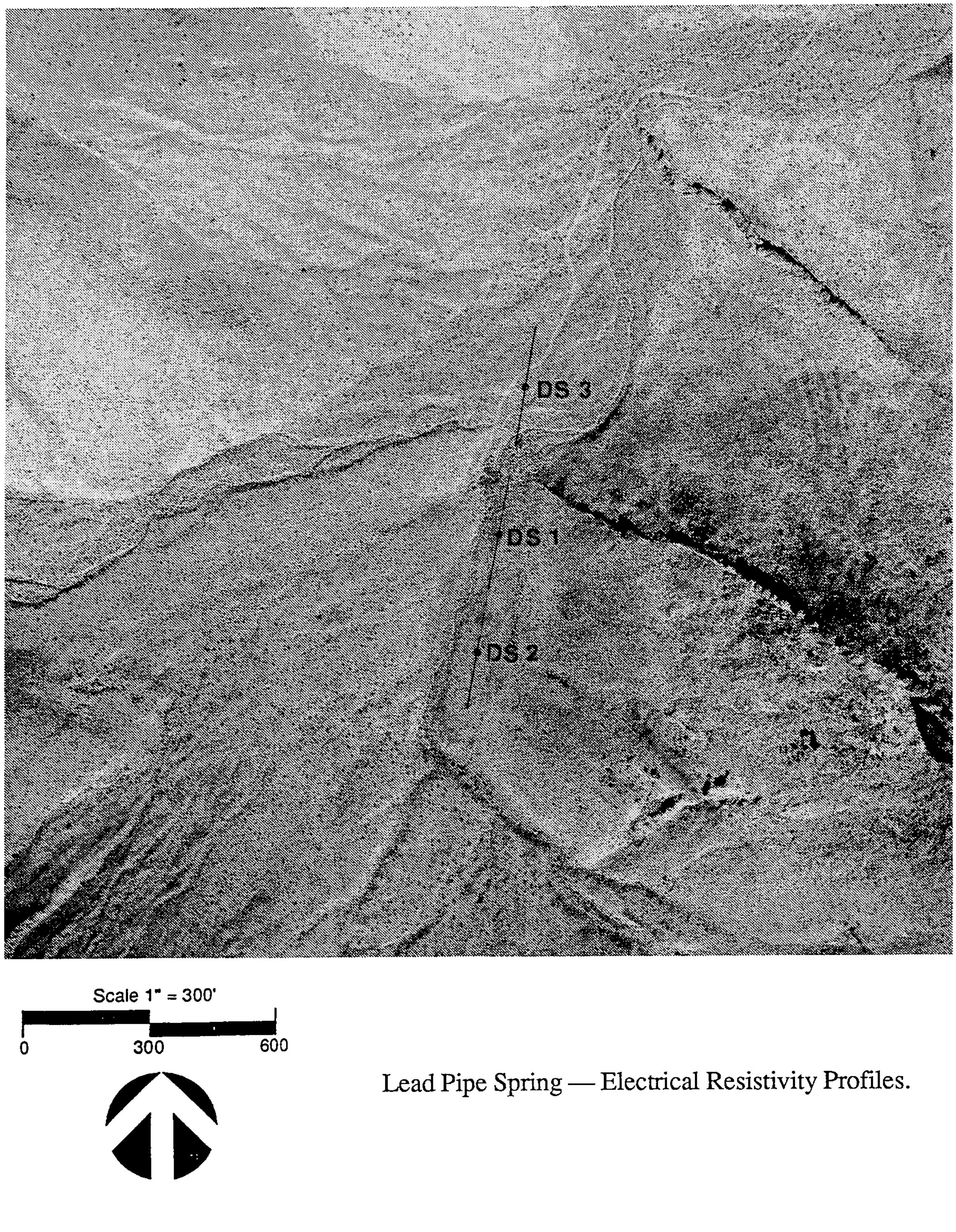


Indian Garden Spring — Electrical Resistivity Profiles.

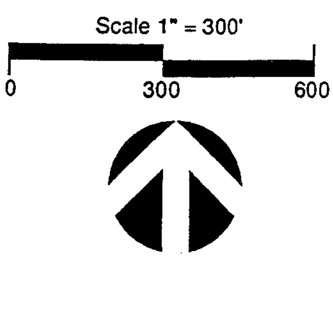




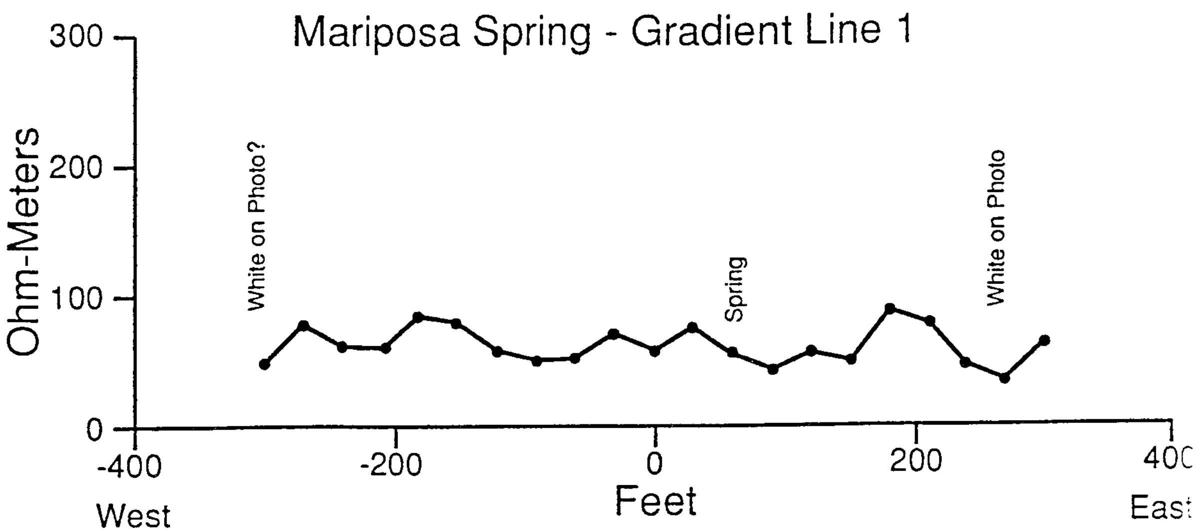
Indian Garden Spring — Electrical Resistivity Profiles.



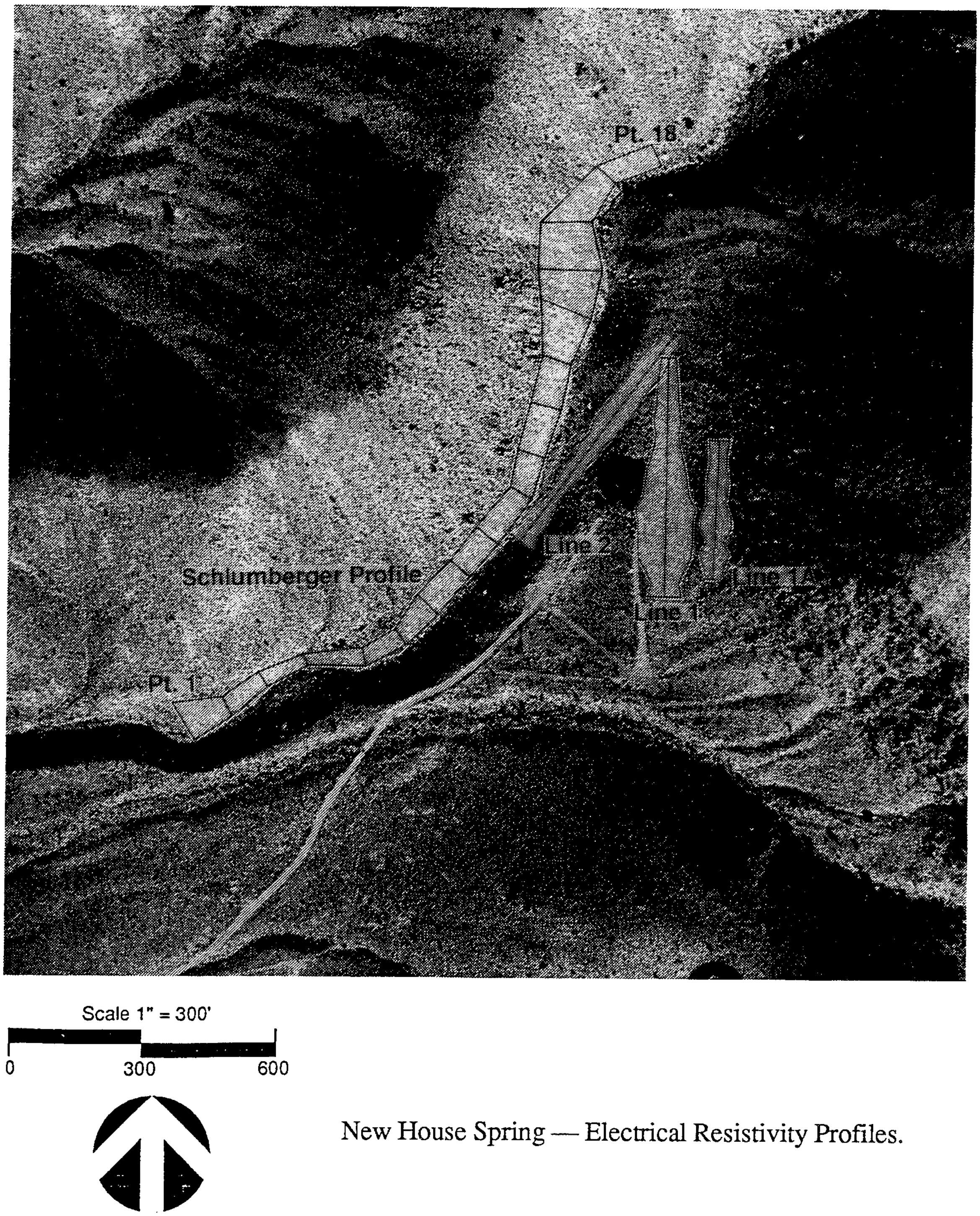
Lead Pipe Spring — Electrical Resistivity Profiles.



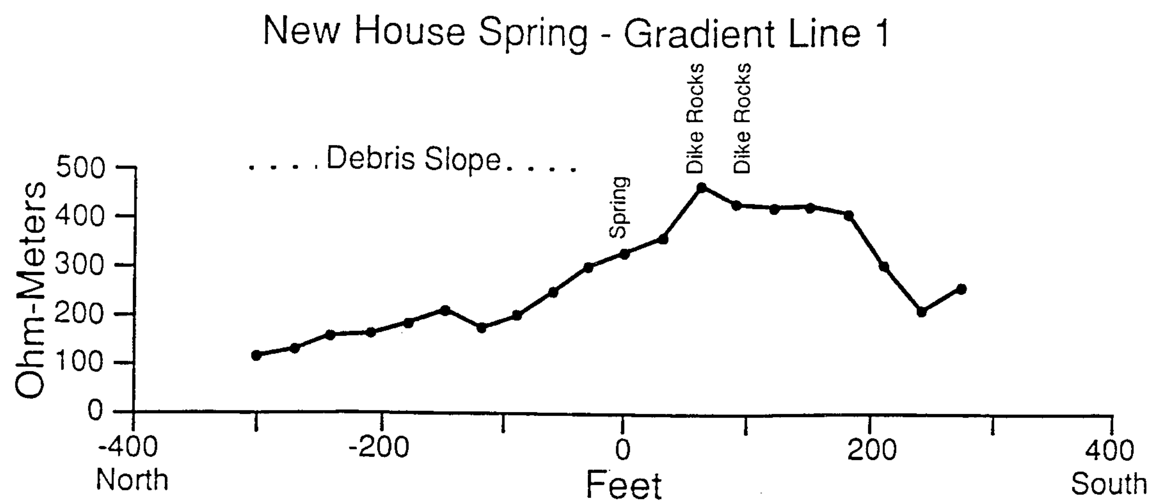
Mariposa Spring — Electrical Resistivity Profiles.

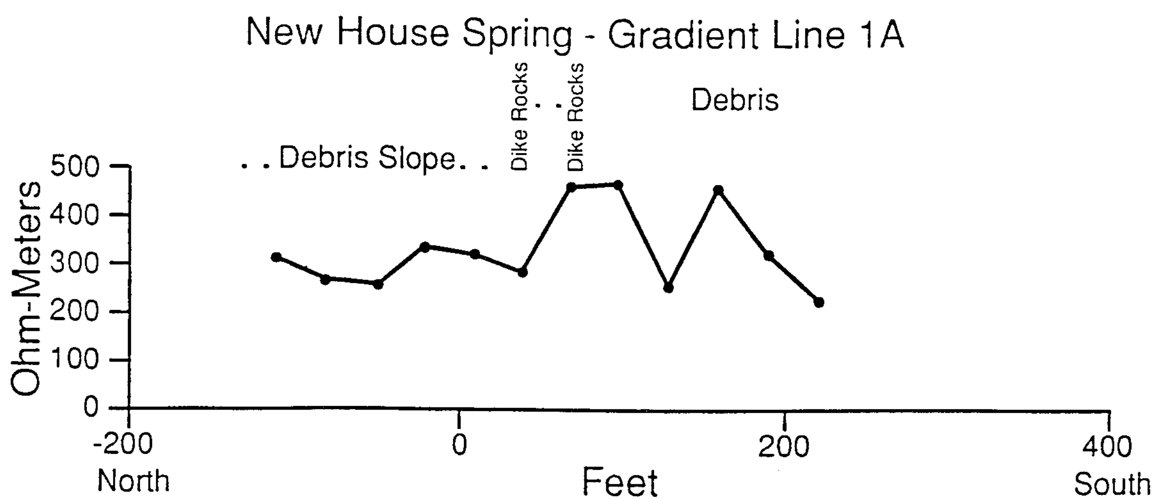


Mariposa Spring — Electrical Resistivity Profiles.



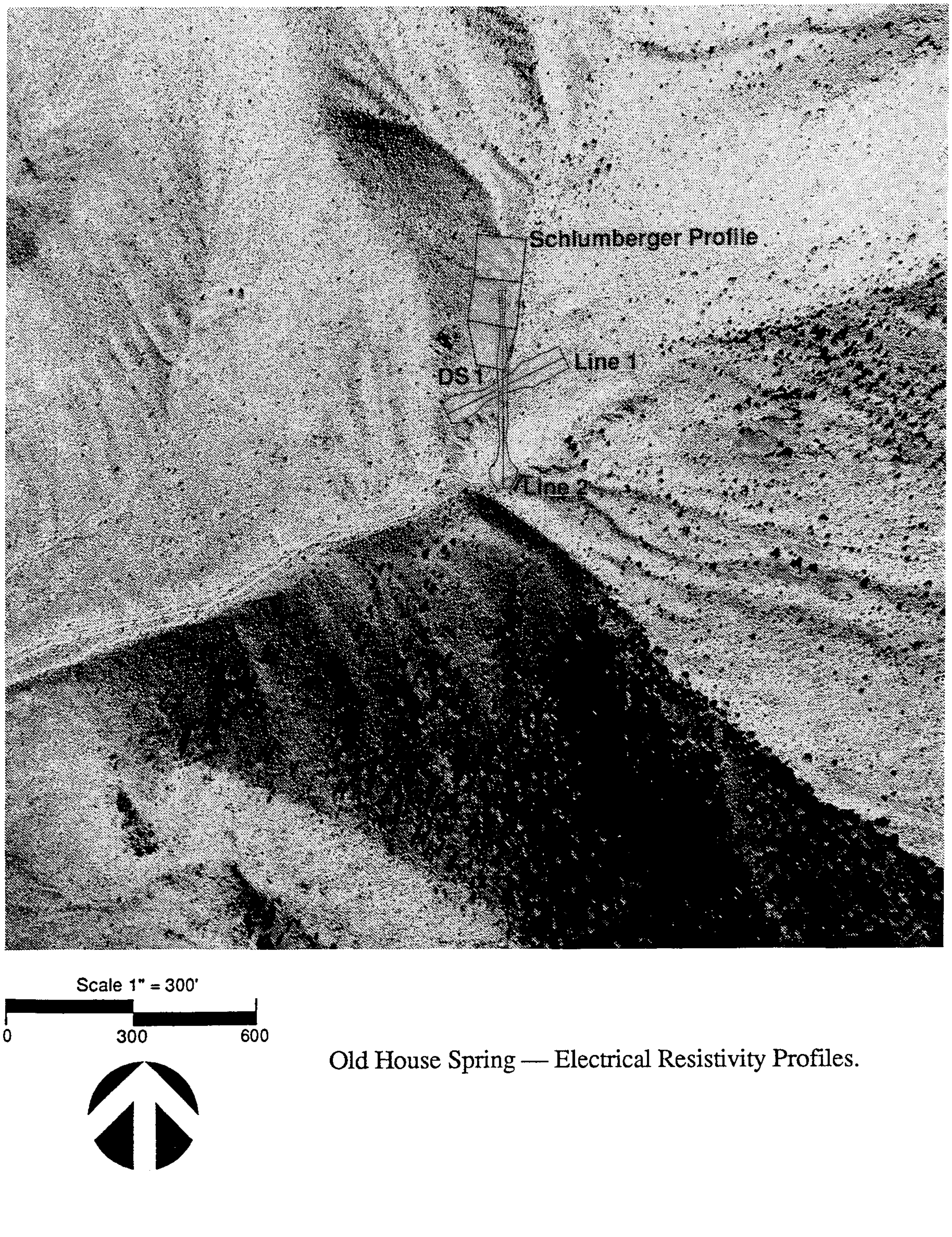
New House Spring — Electrical Resistivity Profiles.



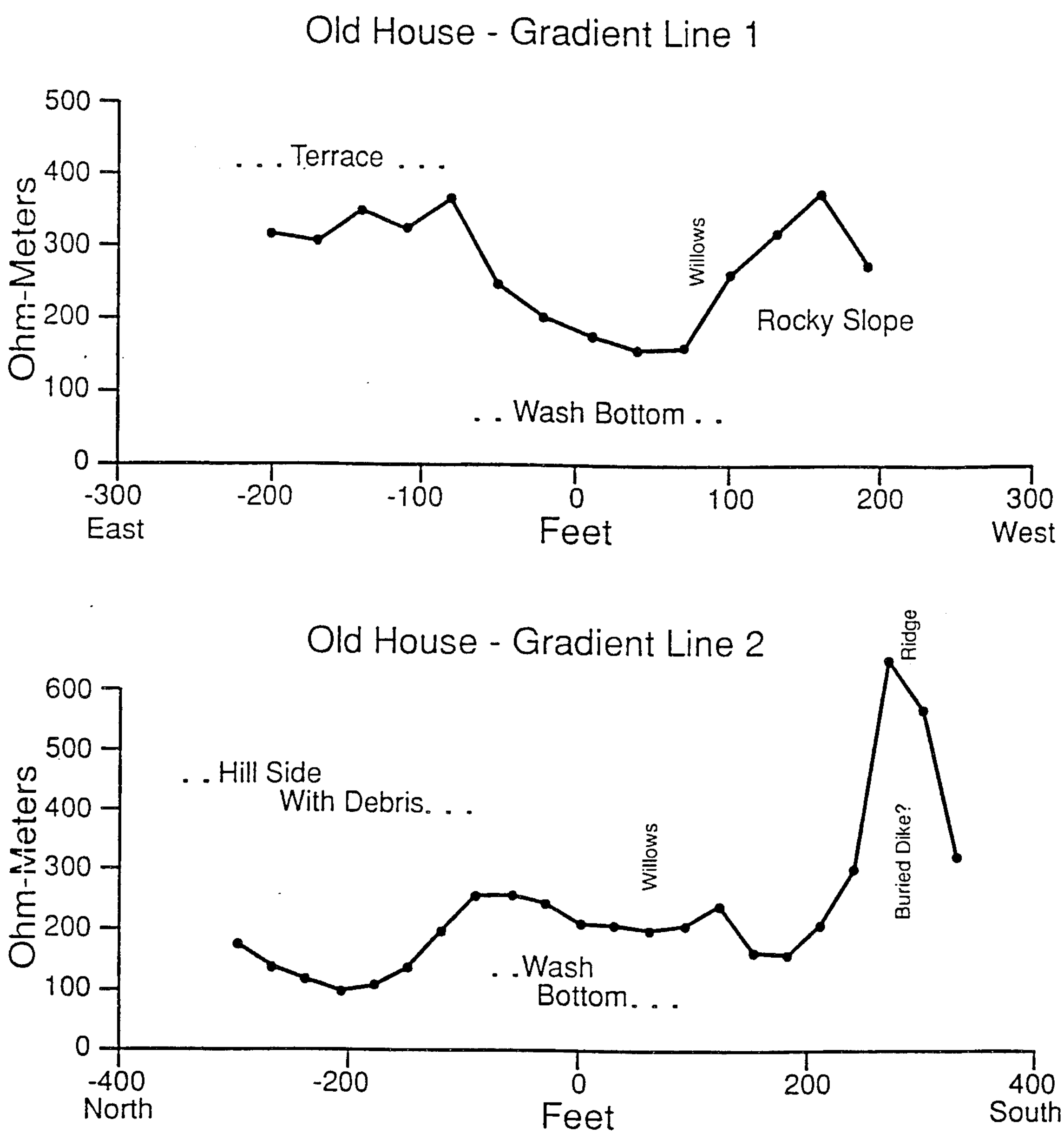


New House Spring — Electrical Resistivity Profiles.

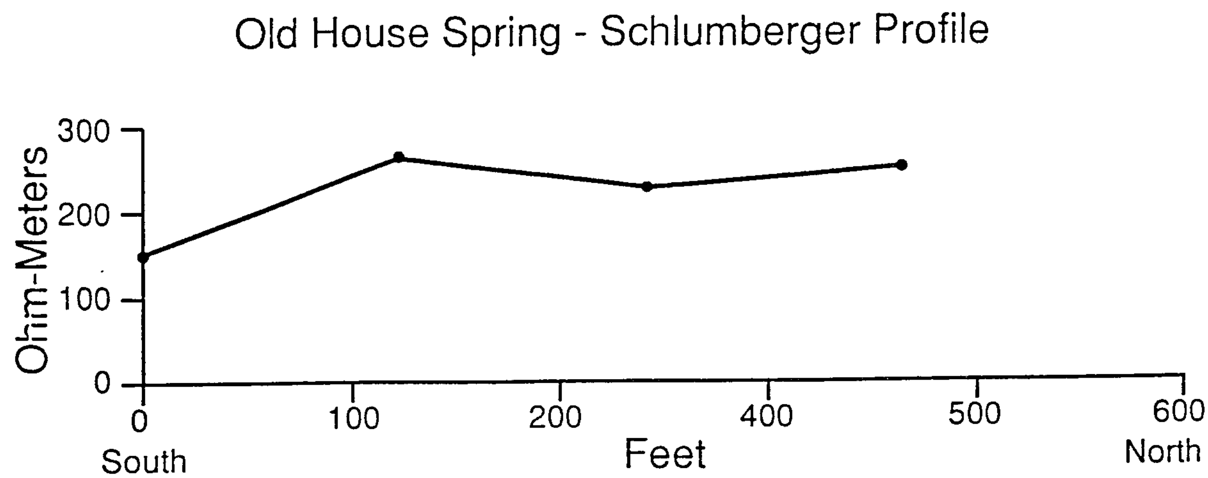
New House Spring — Electrical Resistivity Profiles.



Old House Spring — Electrical Resistivity Profiles.



Old House Spring — Electrical Resistivity Profiles.

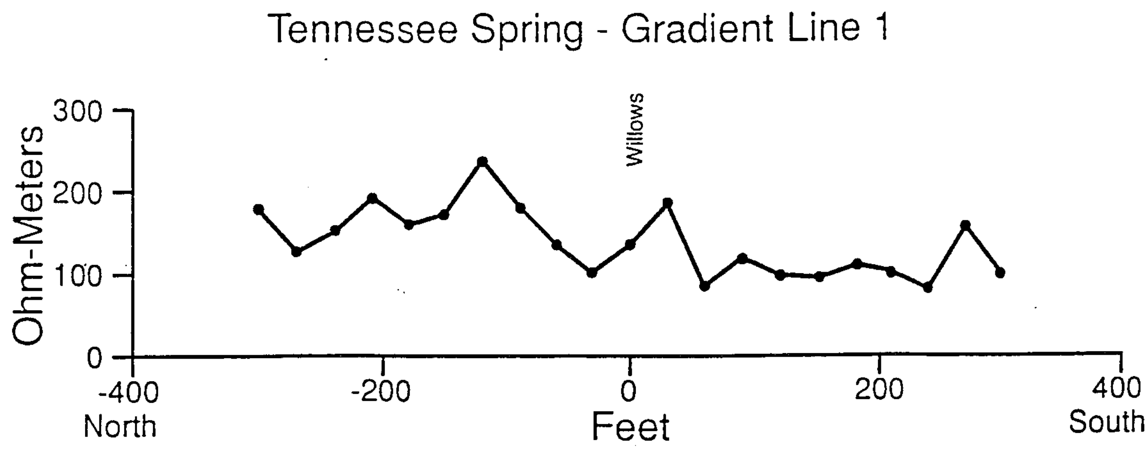


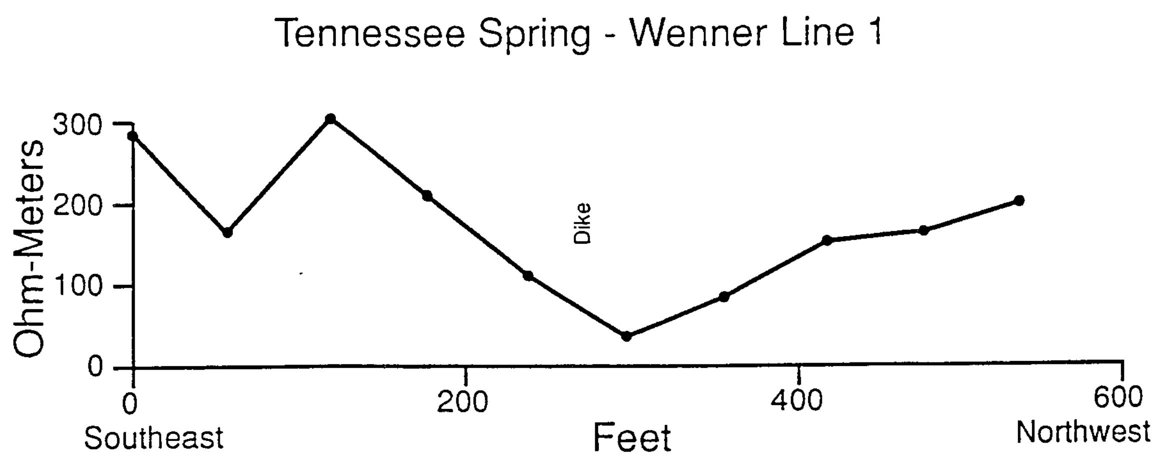
Old House Spring — Electrical Resistivity Profiles.

Scale 1" = 300'

0 300 600

Tennessee Spring — Electrical Resistivity Profiles.

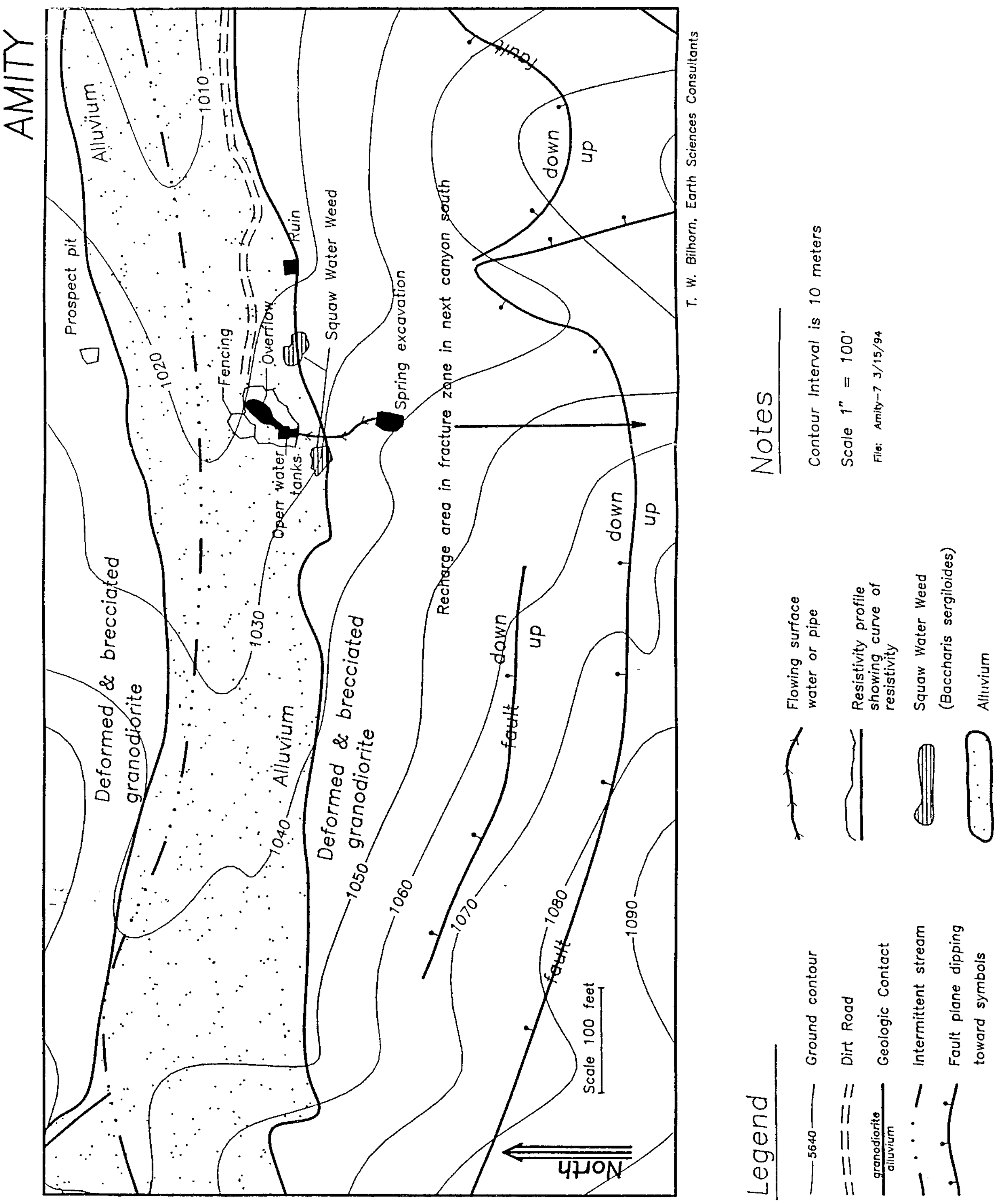


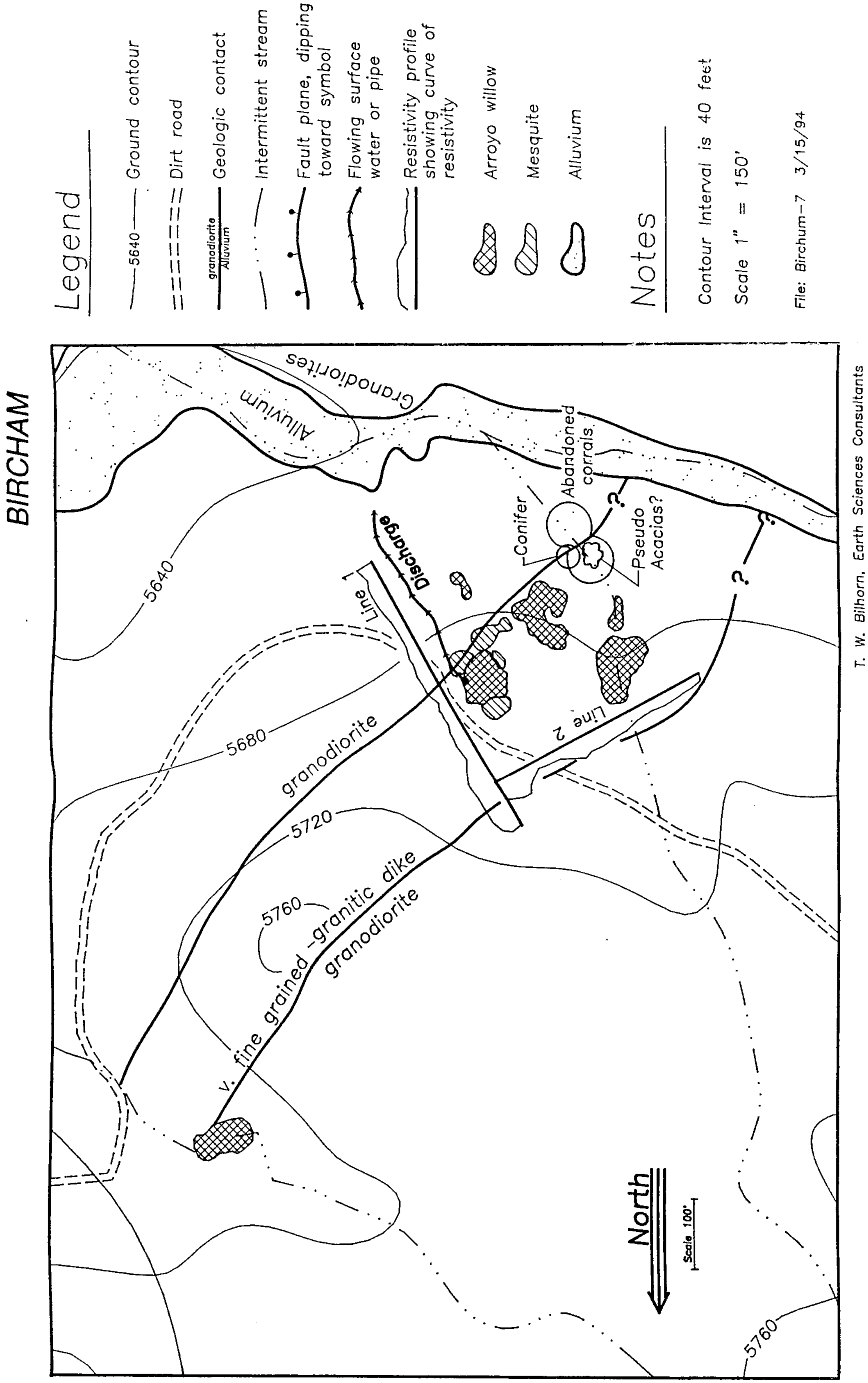


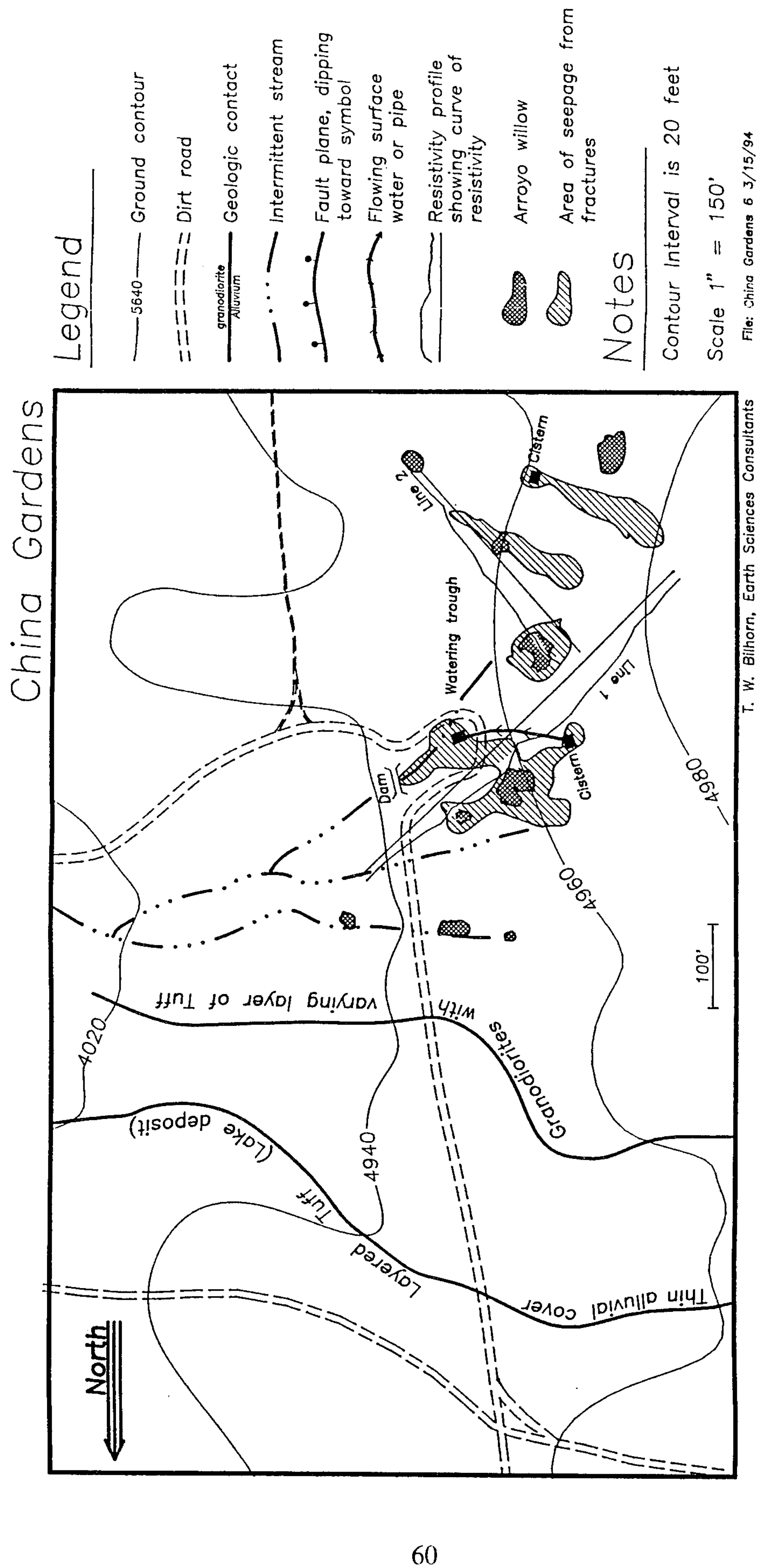
Tennessee Spring — Electrical Resistivity Profiles.

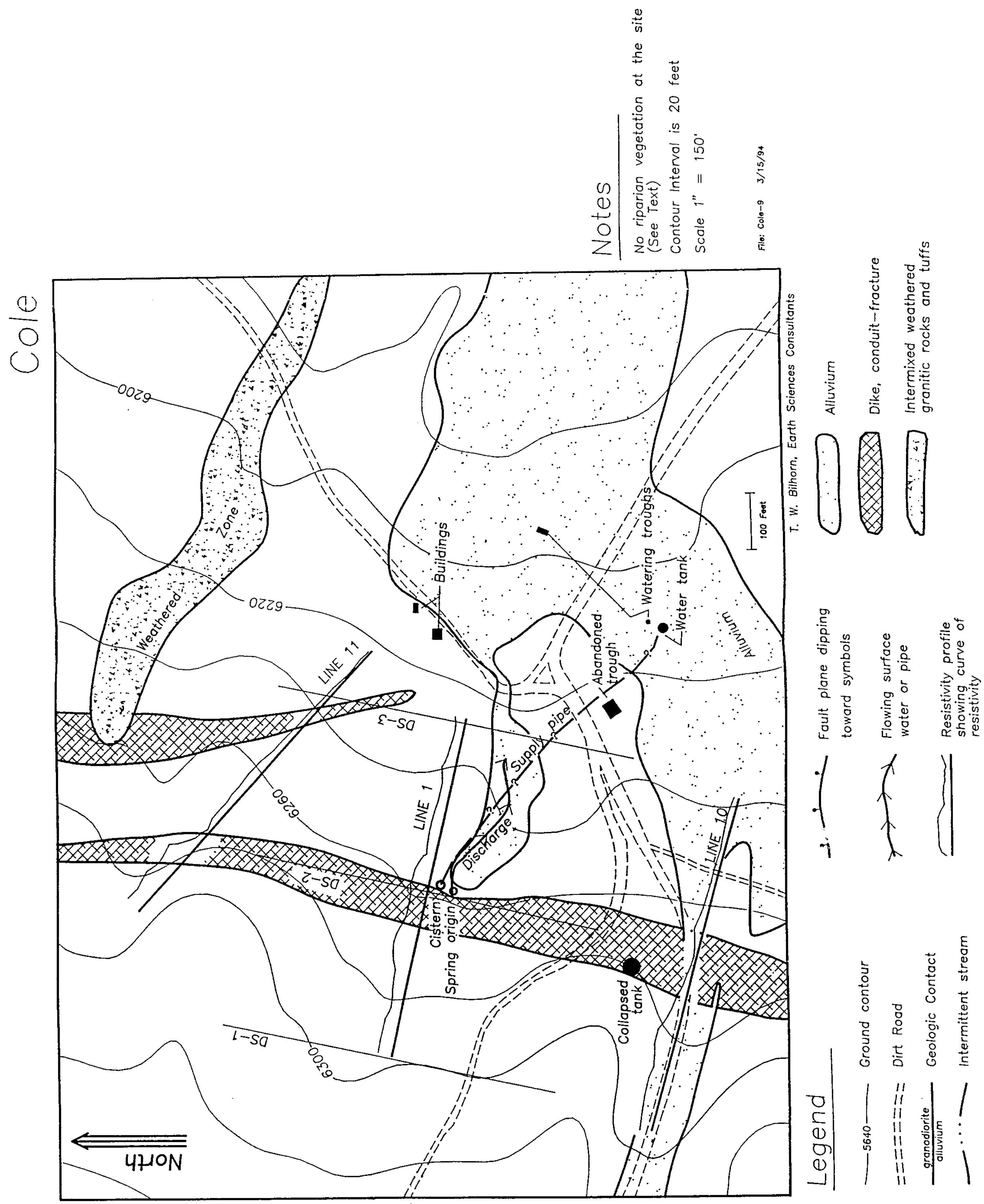
Appendix C

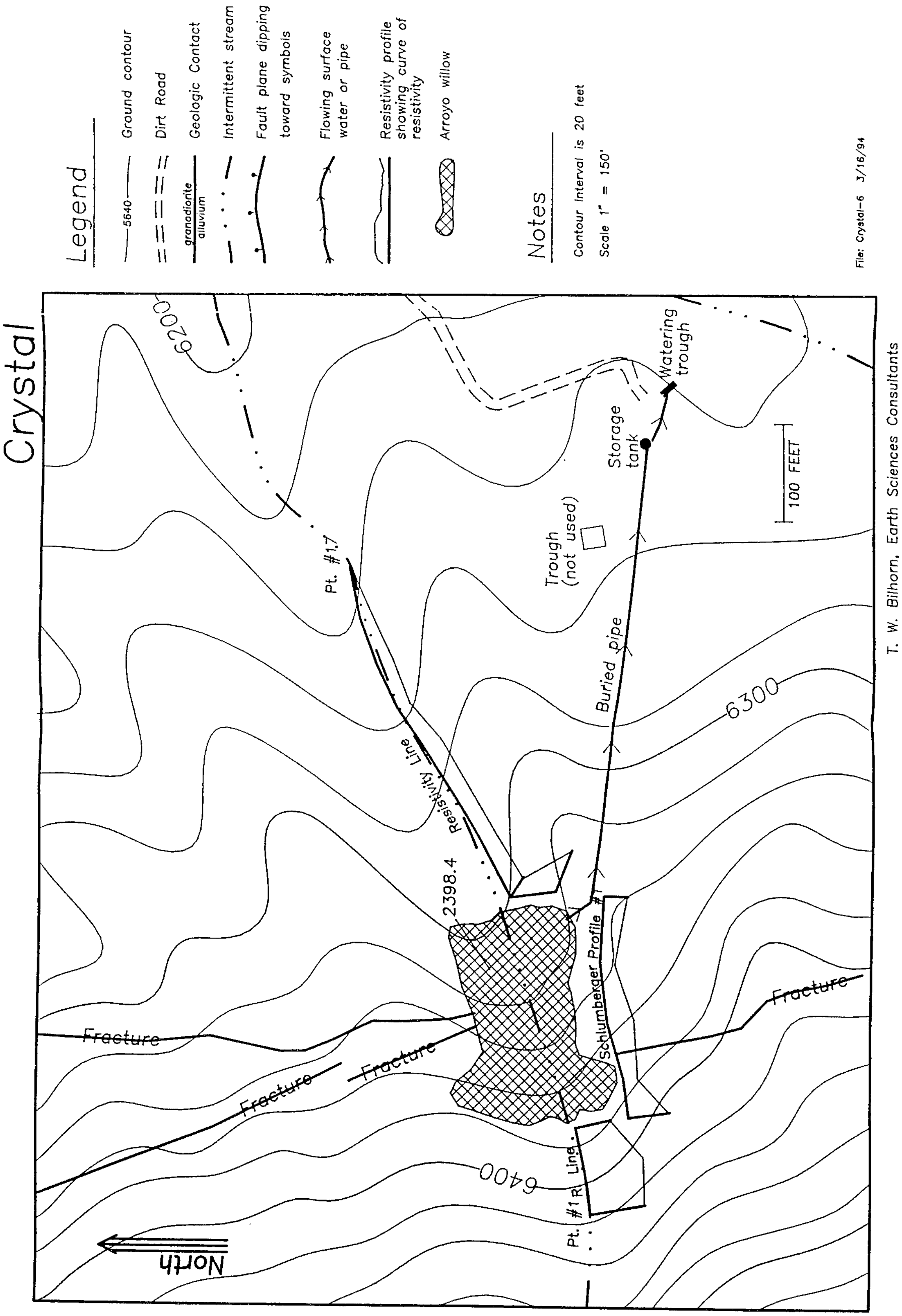
GEOLOGIC MAPS

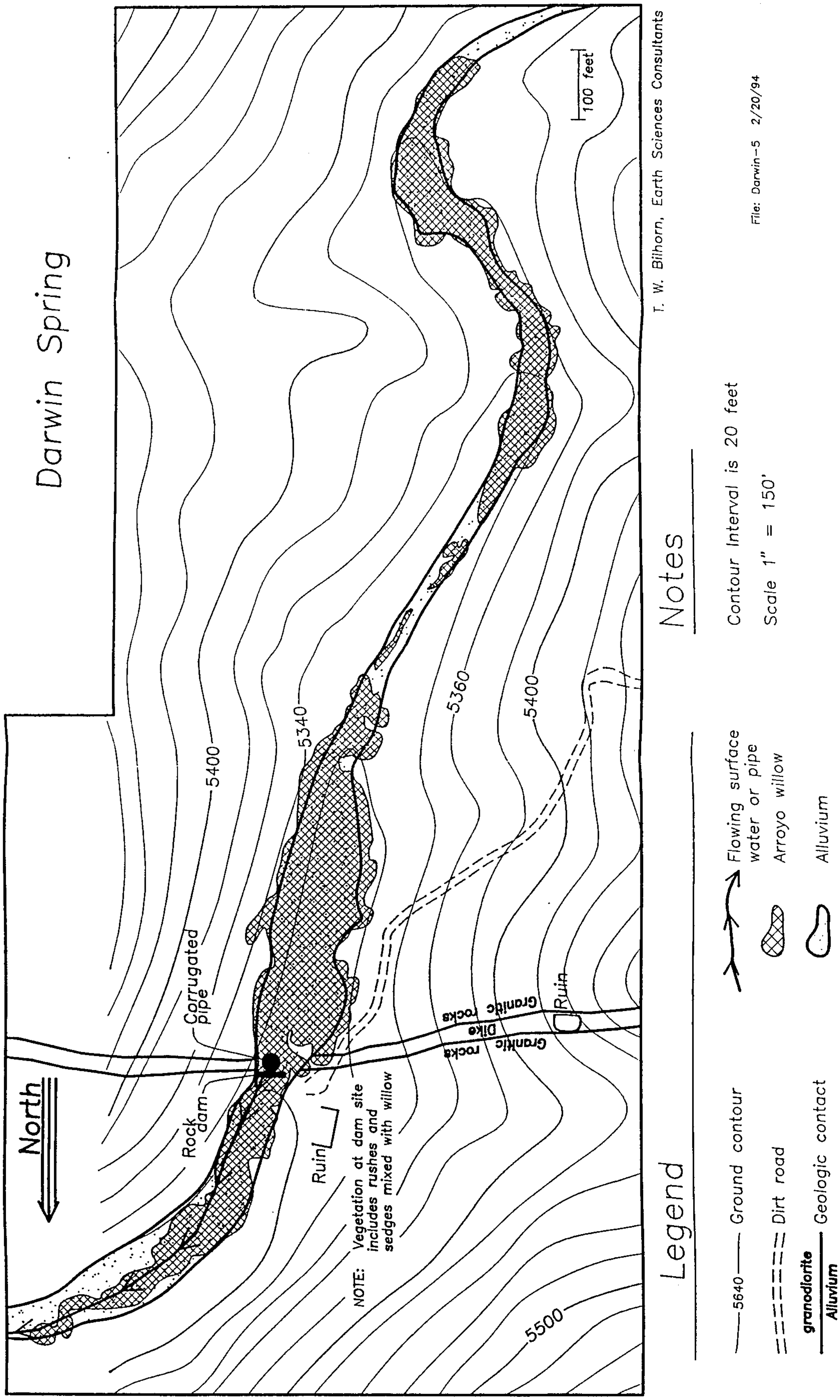

AMITY
Alluvium
Prospect pit
Ruin
Squaw Water Weed
Fencing
Overflow
Spring excavation
Open water tanks
Recharge area in fracture zone in next canyon south
Deformed & brecciated granodiorite
Alluvium
Deformed & brecciated granodiorite
1010
1020
1030
1040
1050
1060
1070
1080
1090
fault
down
up
down
up
fault
down
up
fault
Scale 100 feet
North
T. W. Bilhorn, Earth Sciences Consultants
Legend
5640 Ground contour
Dirt Road
granodiorite alluvium Geologic Contact
Intermittent stream
Fault plane dipping toward symbols
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Squaw Water Weed (Baccharis sergiloides)
Alluvium
Notes
Contour Interval is 10 meters
Scale 1" = 100'
File: Amity-7 3/15/94

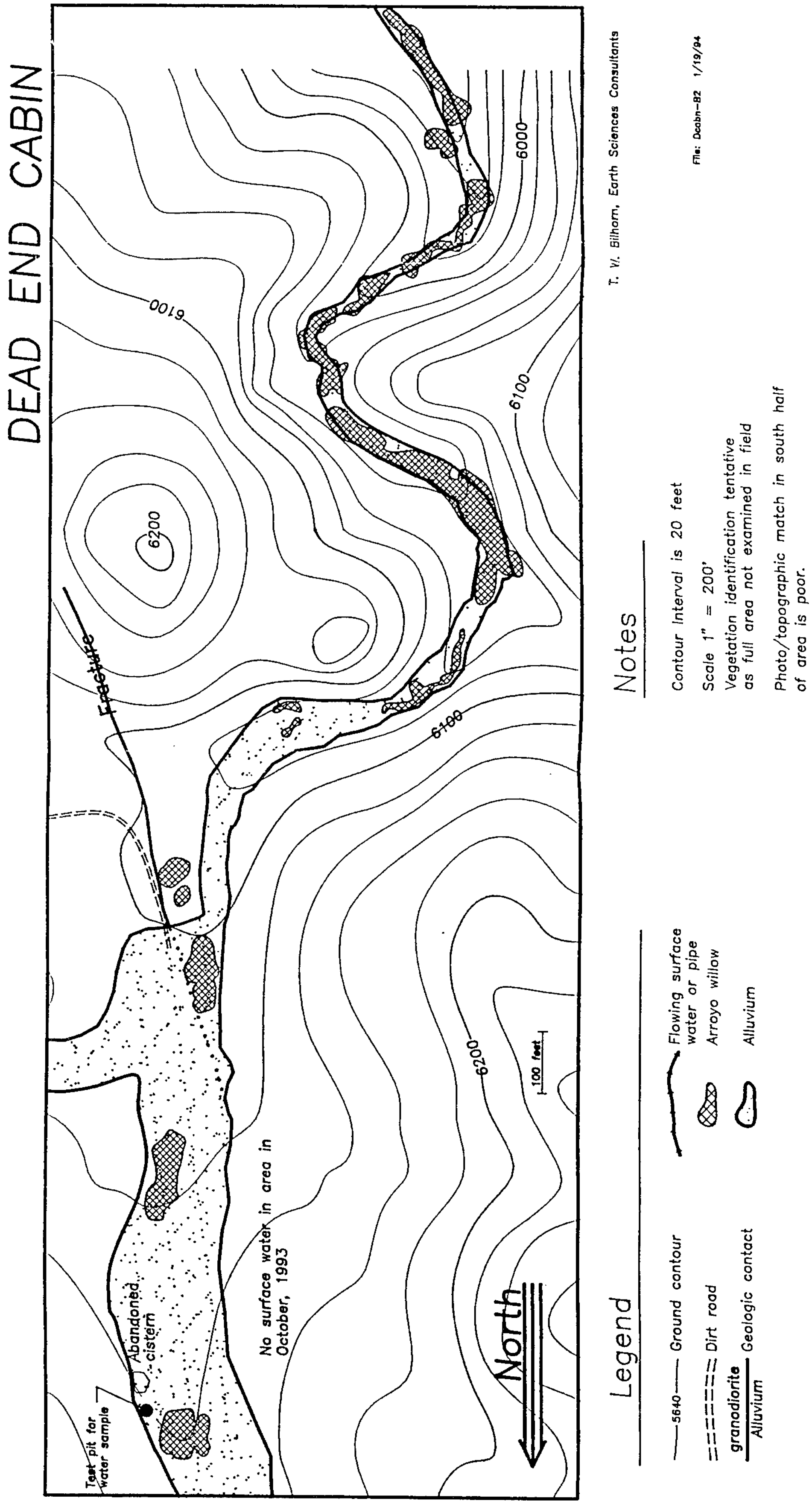

BIRCHAM
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Mesquite
Alluvium
Notes
Contour Interval is 40 feet
Scale 1" = 150'
File: Birchum-7 3/15/94
Granodiorites
Alluvium
Abandoned corrals
Conifer
Pseudo Acacias?
Discharge
Line 1
Line 2
5640
5680
granodiorite
5720
5760
v. fine grained -granitic dike
granodiorite
North
Scale 100'
5760
T. W. Bilhorn, Earth Sciences Consultants

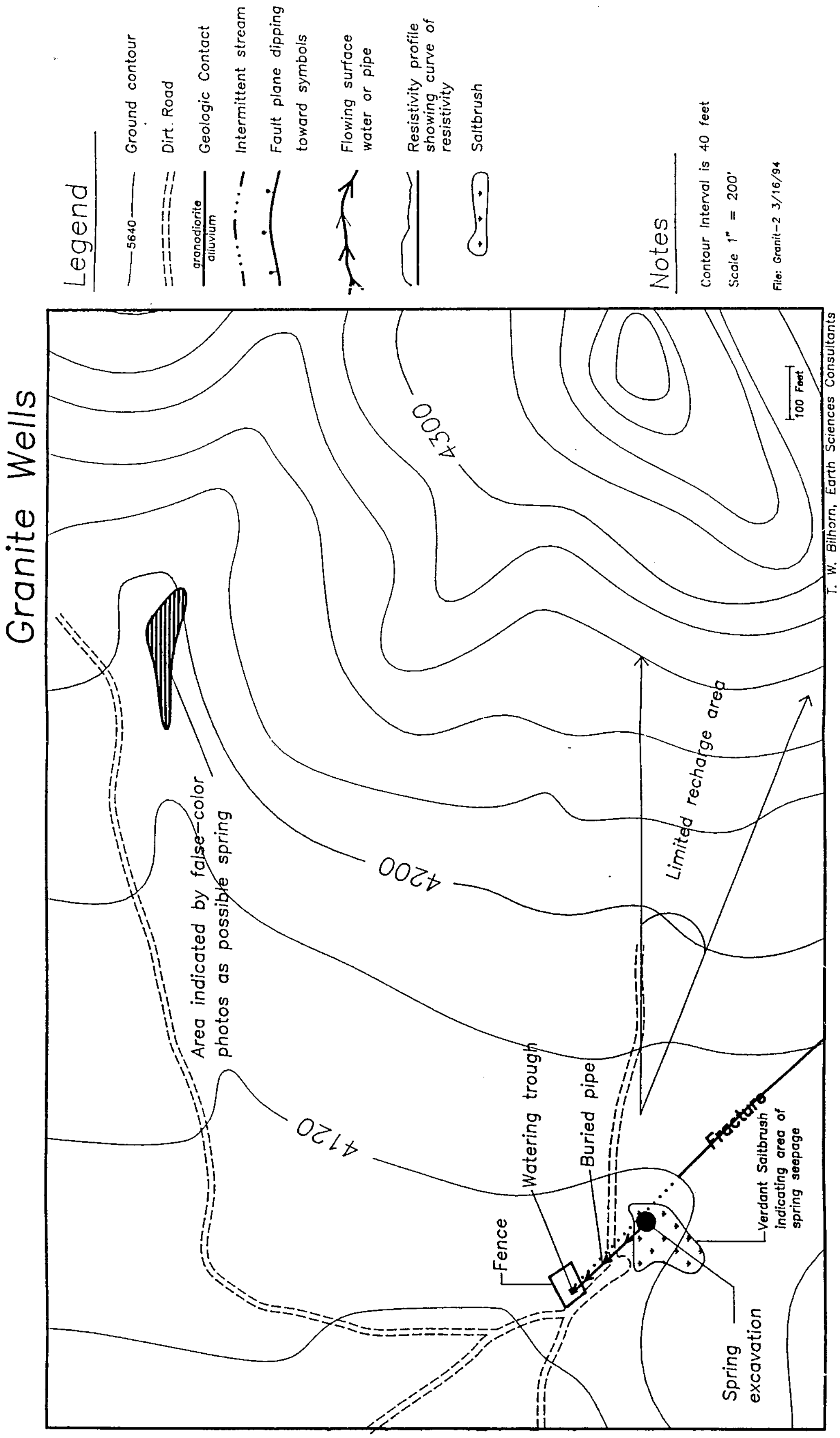

China Gardens
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Area of seepage from fractures
Notes
Contour Interval is 20 feet
Scale 1" = 150'
File: China Gardens 6 3/15/94
T. W. Bilhorn, Earth Sciences Consultants
North
Line 2
Cistern
Watering trough
Line 1
Dam
Cistern
4980
4960
4940
4020
100'
varying layer of Tuff
with
Granodiorites
(Lake deposit)
Tuff
Layered
Thin alluvial cover


Cole
Notes
No riparian vegetation at the site (See Text)
Contour Interval is 20 feet
Scale 1" = 150'
File: Cole-9 3/15/94
T. W. Bilhorn, Earth Sciences Consultants
100 Feet
North
Weathered Zone
Buildings
Watering troughs
Water tank
Abandoned trough
Alluvium
Supply pipe
Discharge
Cistern
Spring origin
Collapsed tank
LINE 11
LINE 1
LINE 10
DS-1
DS-2
DS-3
6200
6220
6260
6300
Legend
5640 Ground contour
Dirt Road
granodiorite alluvium Geologic Contact
Intermittent stream
Fault plane dipping toward symbols
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Alluvium
Dike, conduit-fracture
Intermixed weathered granitic rocks and tuffs

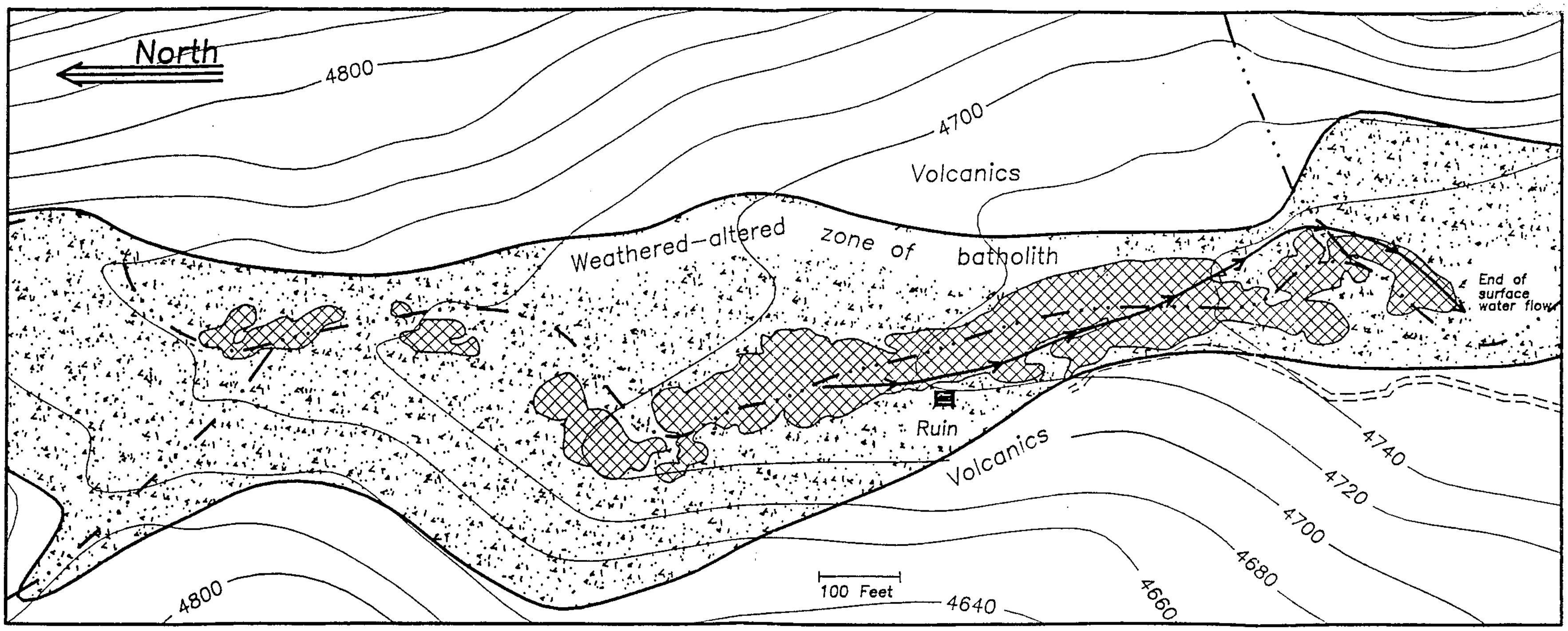

Crystal
Legend
5640
Ground contour
Dirt Road
granodiorite
alluvium
Geologic Contact
Intermittent stream
Fault plane dipping toward symbols
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Notes
Contour Interval is 20 feet
Scale 1" = 150'
File: Crystal-6 3/16/94
T. W. Bilhorn, Earth Sciences Consultants
6200
Watering trough
Storage tank
Trough (not used)
100 FEET
Pt. #17
Buried pipe
6300
Resistivity Line
2398.4
Schlumberger Profile #1
Fracture
Fracture
Fracture
Fracture
Pt. #1 R. Line
6400
North


Darwin Spring
North
Rock dam
Corrugated pipe
5400
5340
5360
5400
5500
Granitic rocks
Dike
Granitic rocks
Ruin
Ruin
NOTE: Vegetation at dam site includes rushes and sedges mixed with willow
100 feet
T. W. Bilhorn, Earth Sciences Consultants
File: Darwin-5 2/20/94
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Flowing surface water or pipe
Arroyo willow
Alluvium
Notes
Contour Interval is 20 feet
Scale 1" = 150'


DEAD END CABIN
Fracture
6100
6200
6000
6100
6100
6200
100 feet
Test pit for water sample
Abandoned cistern
No surface water in area in October, 1993
North
T. V. Bilhorn, Earth Sciences Consultants
File: Dcabn-B2 1/19/94
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Flowing surface water or pipe
Arroyo willow
Alluvium
Notes
Contour Interval is 20 feet
Scale 1" = 200'
Vegetation identification tentative as full area not examined in field
Photo/topographic match in south half of area is poor.


Granite Wells
Legend
5640 Ground contour
Dirt. Road
granodiorite
alluvium
Geologic Contact
Intermittent stream
Fault plane dipping toward symbols
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Saltbrush
Notes
Contour Interval is 40 feet
Scale 1" = 200'
File: Granit-2 3/16/94
100 Feet
T. W. Bilhorn, Earth Sciences Consultants
4300
4200
4120
Area indicated by false-color photos as possible spring
Limited recharge area
Watering trough
Buried pipe
Fence
Fracture
Verdant Saltbrush indicating area of spring seepage
Spring excavation

HAWIEE



Legend

5640 Ground contour

Dirt road

granodiorite / Alluvium Geologic contact

Flowing surface water or pipe

Arroyo willow

Weathered–altered zone

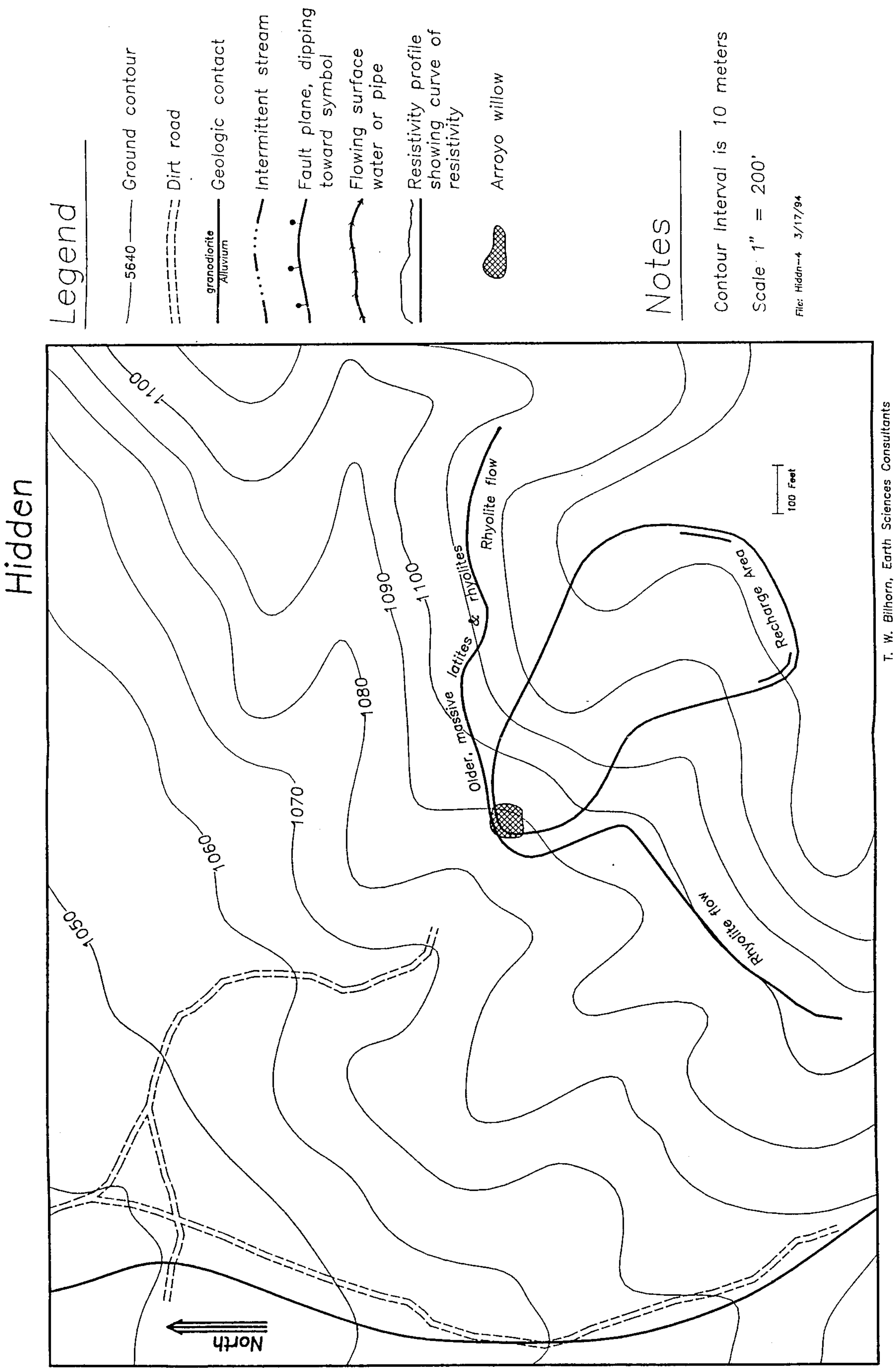
Notes

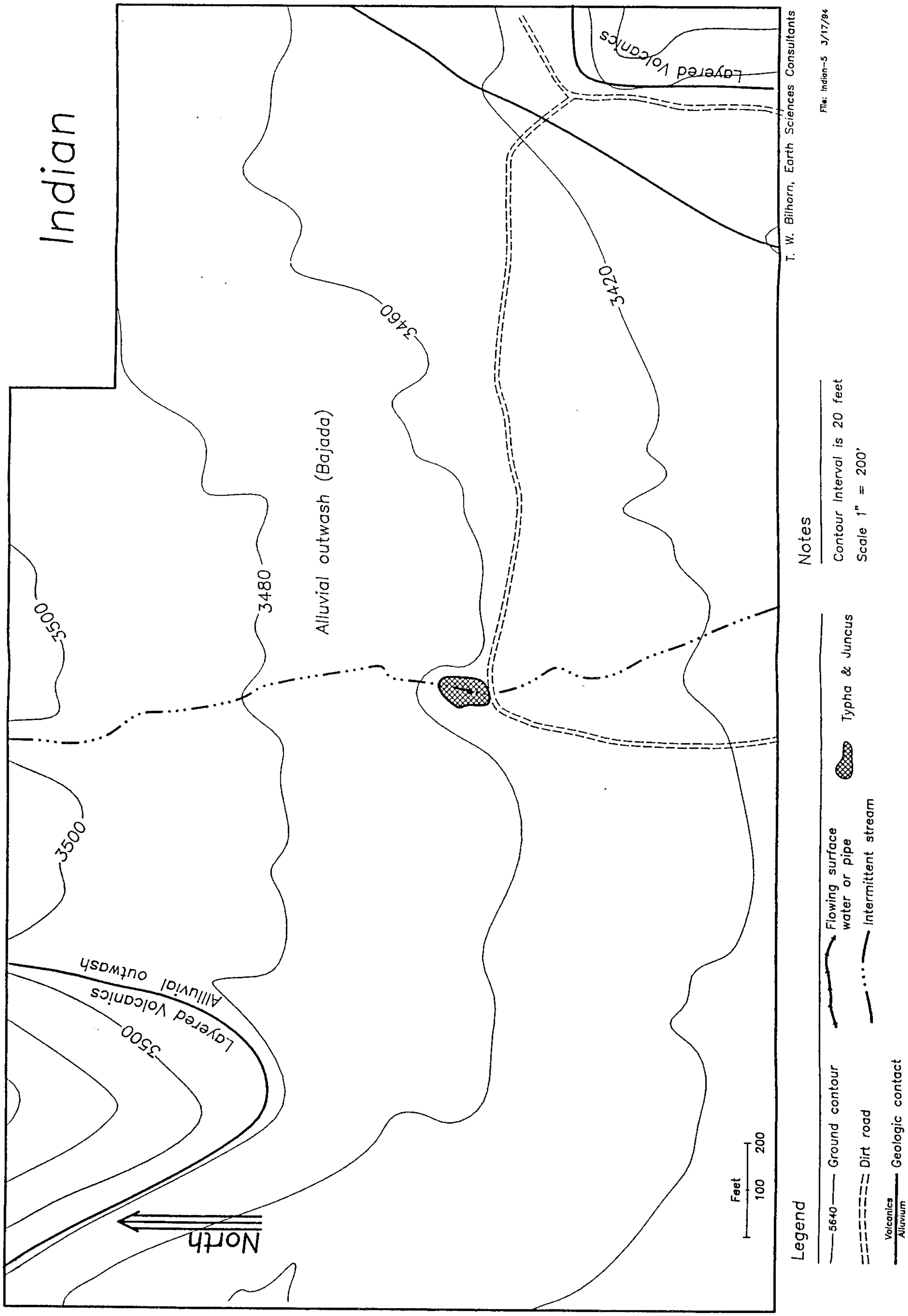
Contour Interval is 20 feet

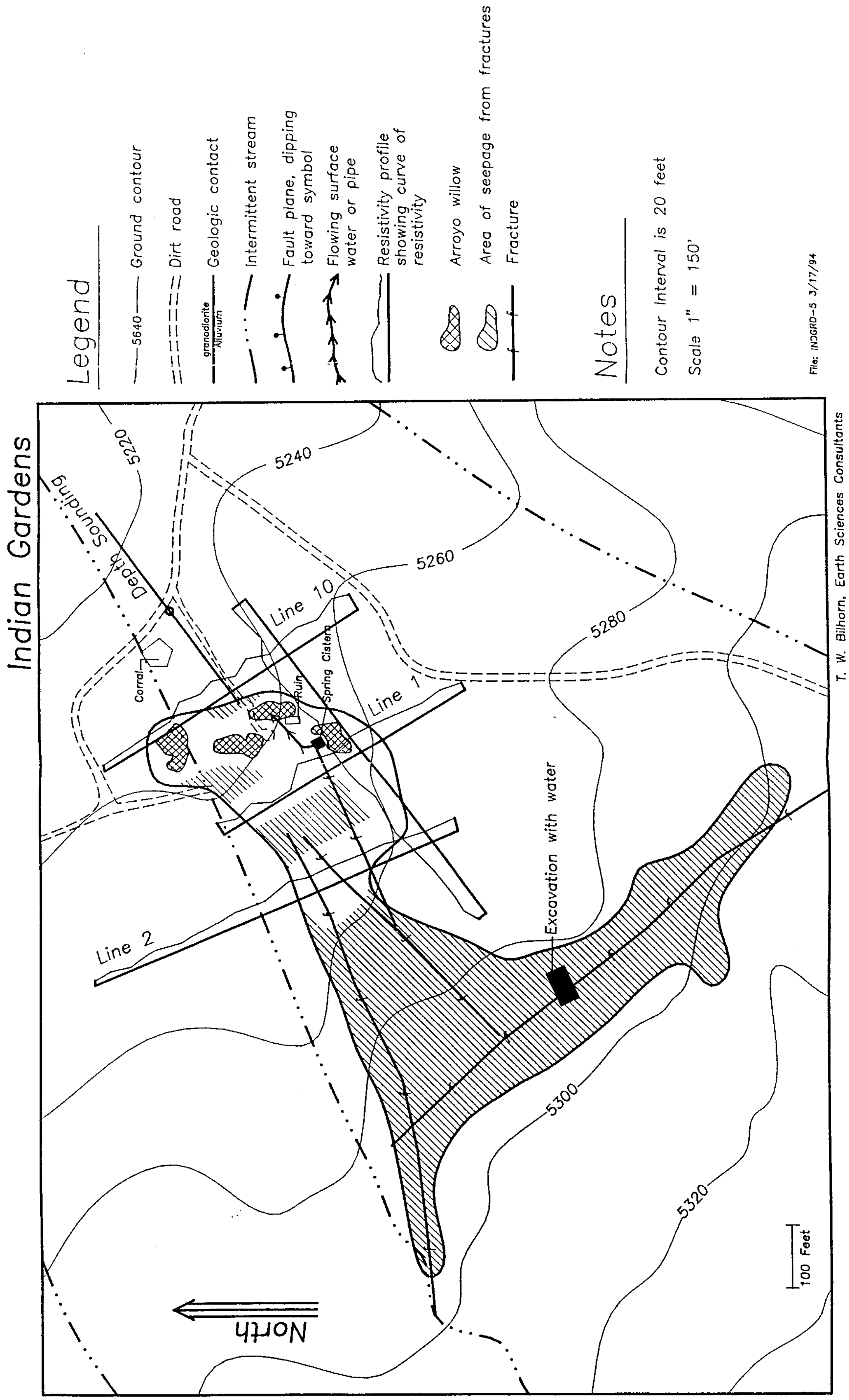
Scale 1" = 150'

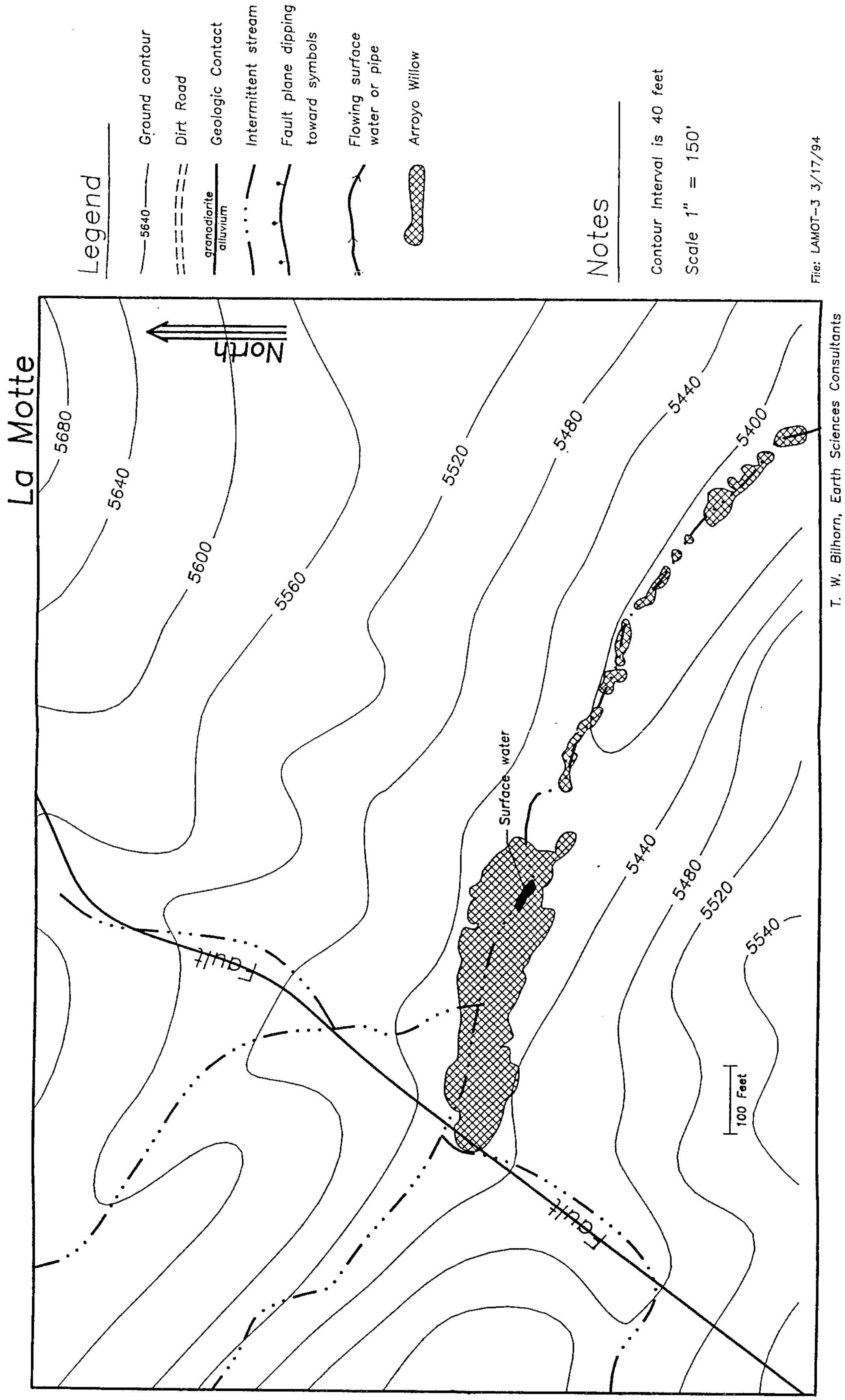
T. W. Bilhorn, Earth Sciences Consultants

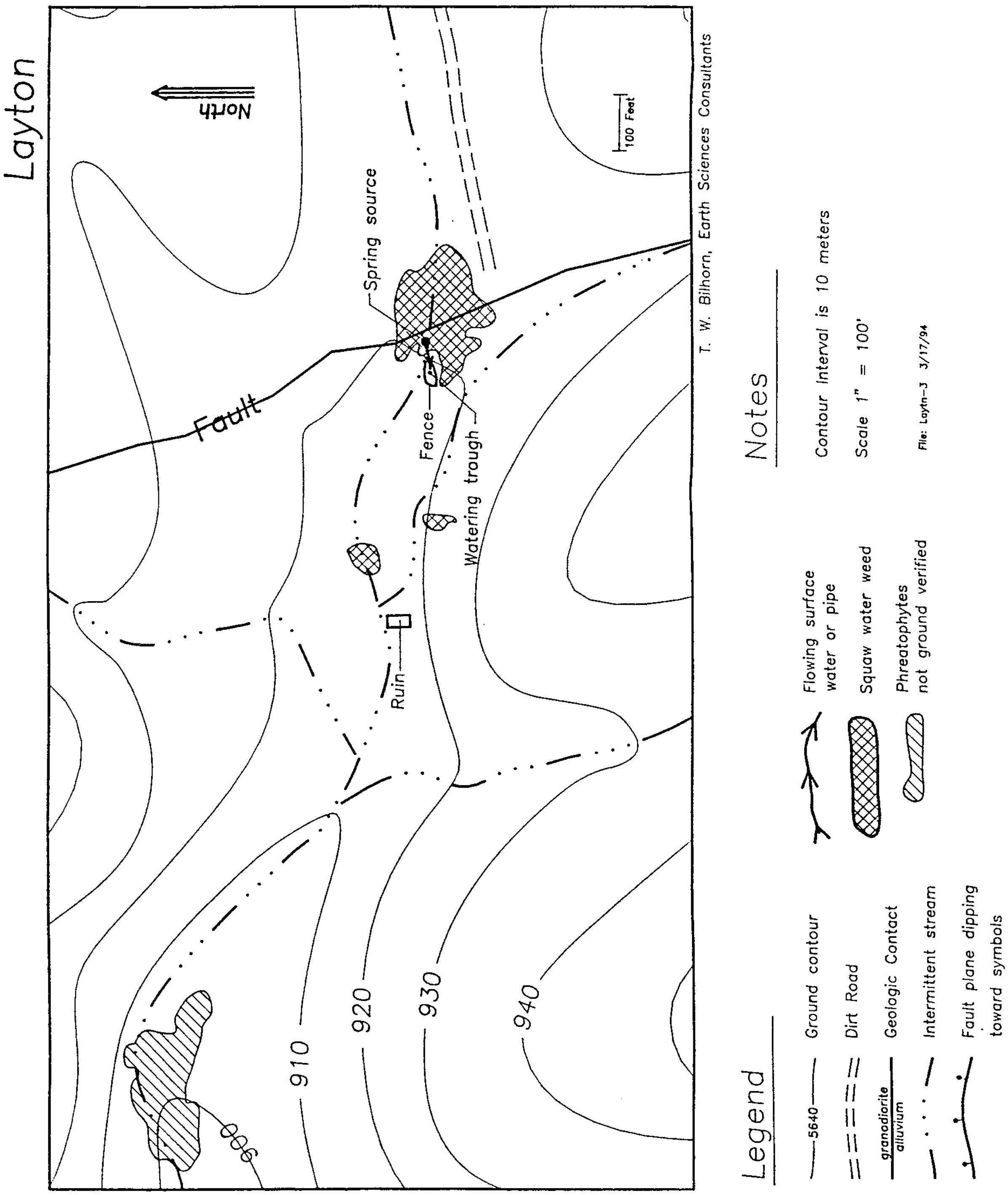
File: Hawiee–3 1/20/94

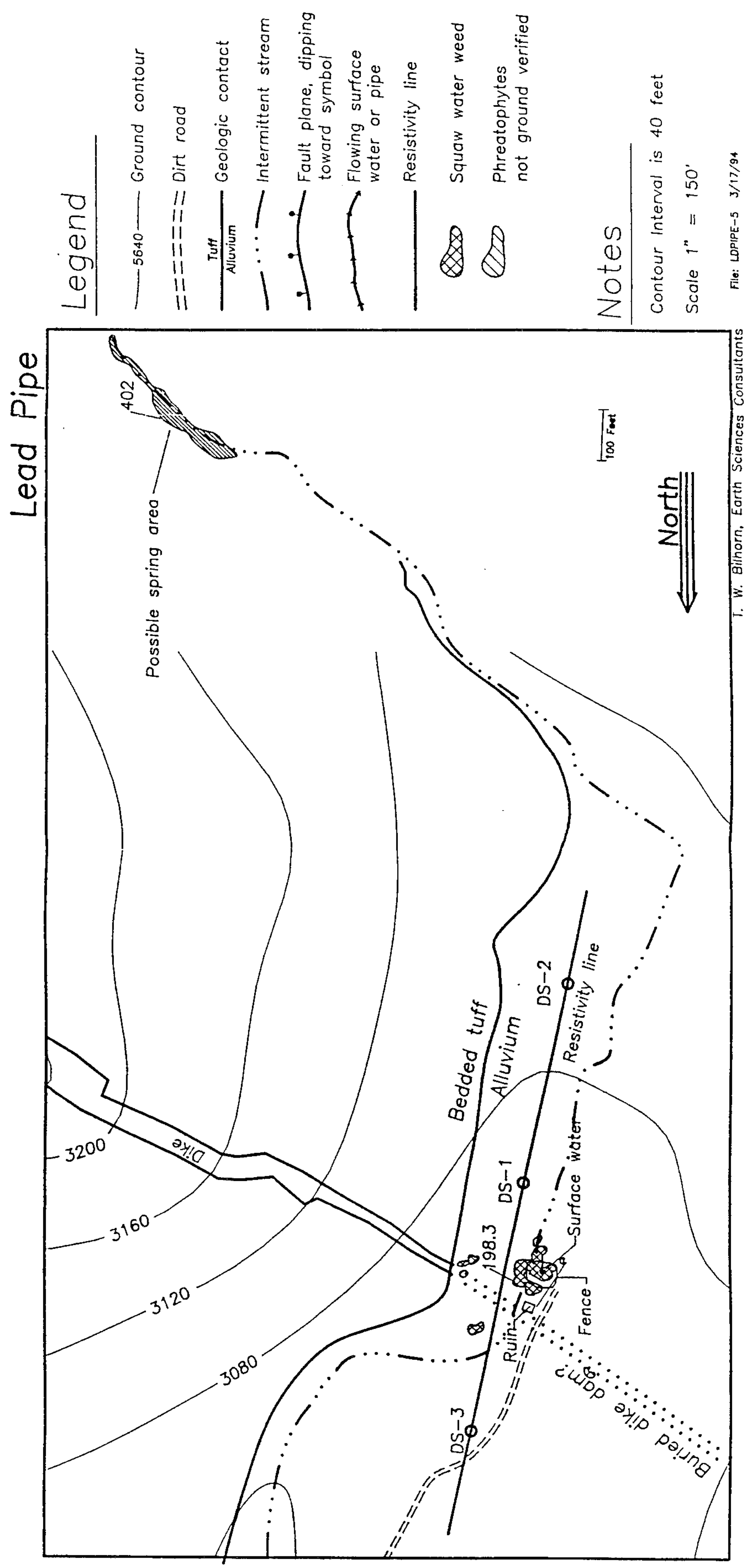

Hidden
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Notes
Contour Interval is 10 meters
Scale 1" = 200'
File: Hiddn-4 3/17/94
1100
1090
1100
1080
1070
1060
1050
Rhyolite flow
Older, massive latites & rhyolites
Recharge Area
100 Feet
Rhyolite flow
North
T. W. Bilhorn, Earth Sciences Consultants

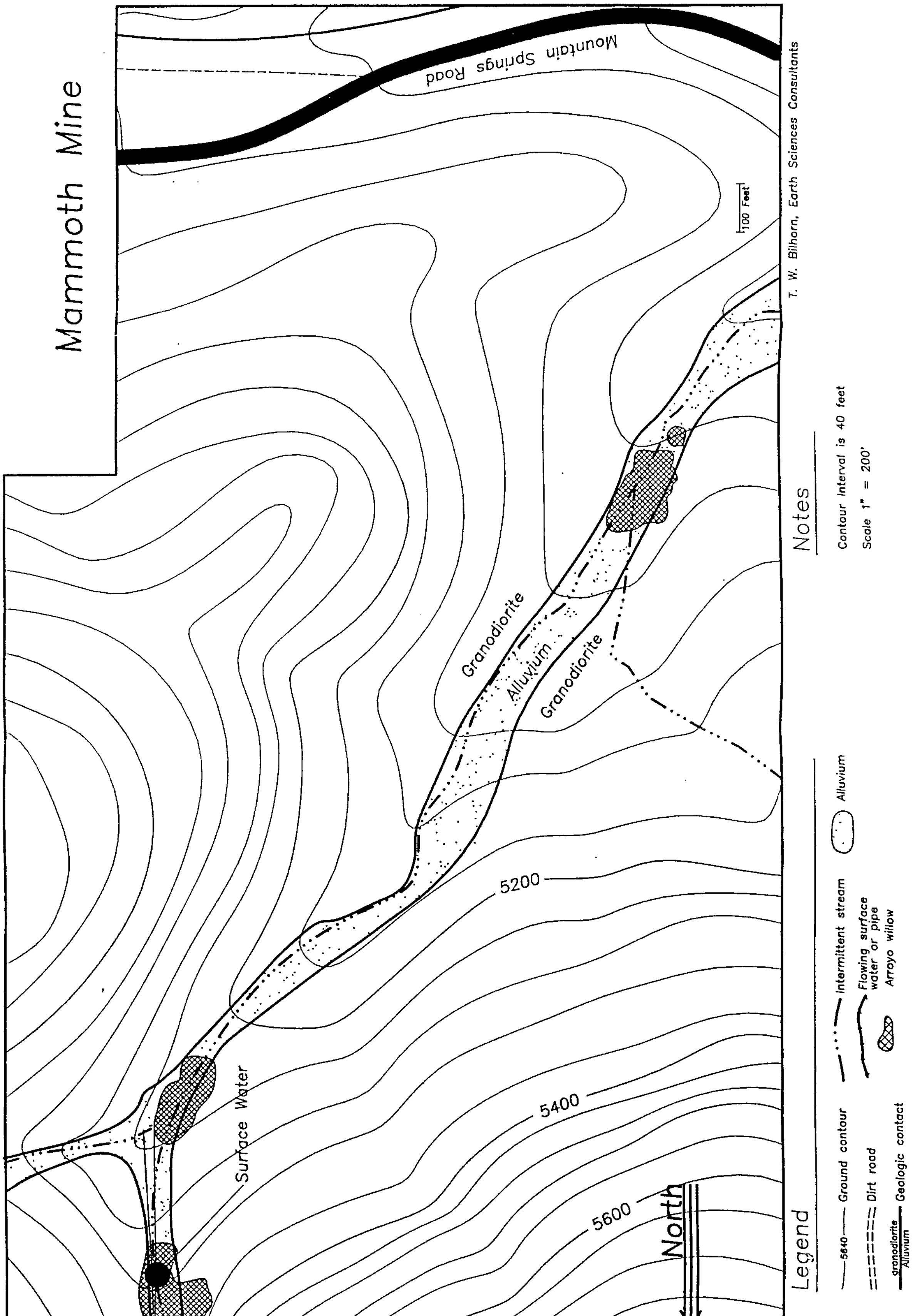

Indian
Layered Volcanics
3420
3460
3480
3500
3500
3500
Alluvial outwash (Bajada)
Layered Volcanics
Allluvial outwash
North
Feet
100 200
Legend
5640 Ground contour
Dirt road
Volcanics
Alluvium
Geologic contact
Flowing surface water or pipe
Intermittent stream
Typha & Juncus
Notes
Contour Interval is 20 feet
Scale 1" = 200'
T. W. Bilhorn, Earth Sciences Consultants
File: Indian-5 3/17/94


Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Area of seepage from fractures
Fracture
Notes
Contour Interval is 20 feet
Scale 1" = 150'
File: IN3GRD-5 3/17/94
Indian Gardens
Depth Sounding
5220
5240
5260
5280
5300
5320
Line 10
Line 1
Line 2
Corral
Ruin
Spring Cistern
Excavation with water
100 Feet
North
T. W. Bilhorn, Earth Sciences Consultants

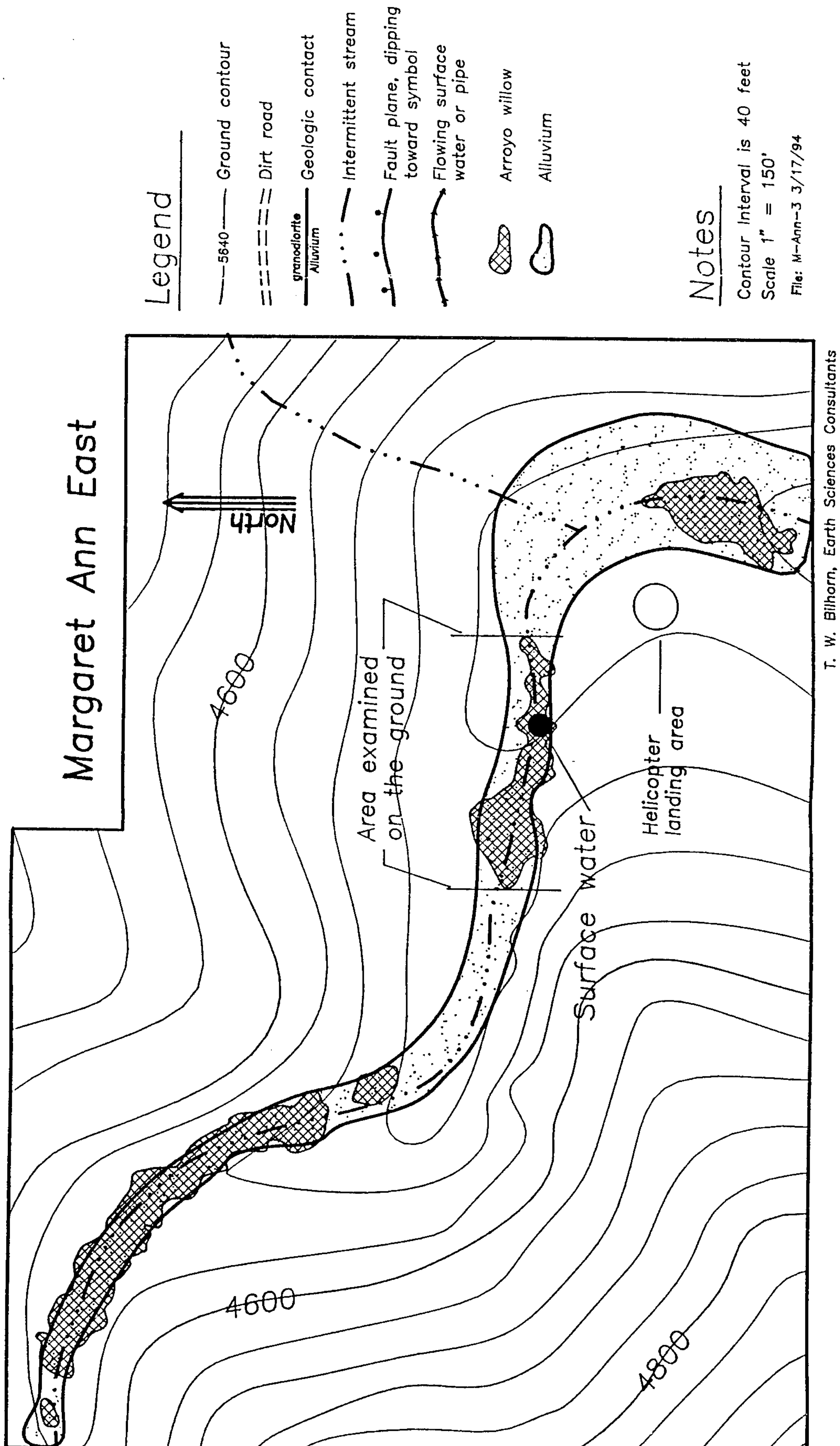

La Motte
Legend
5640
Ground contour
Dirt Road
granodiorite
alluvium
Geologic Contact
Intermittent stream
Fault plane dipping toward symbols
Flowing surface water or pipe
Arroyo Willow
Notes
Contour Interval is 40 feet
Scale 1" = 150'
File: LAMOT-3 3/17/94
North
5680
5640
5600
5560
5520
5480
5440
5400
5540
Surface water
Fault
Fault
100 Feet
T. W. Bilhorn, Earth Sciences Consultants

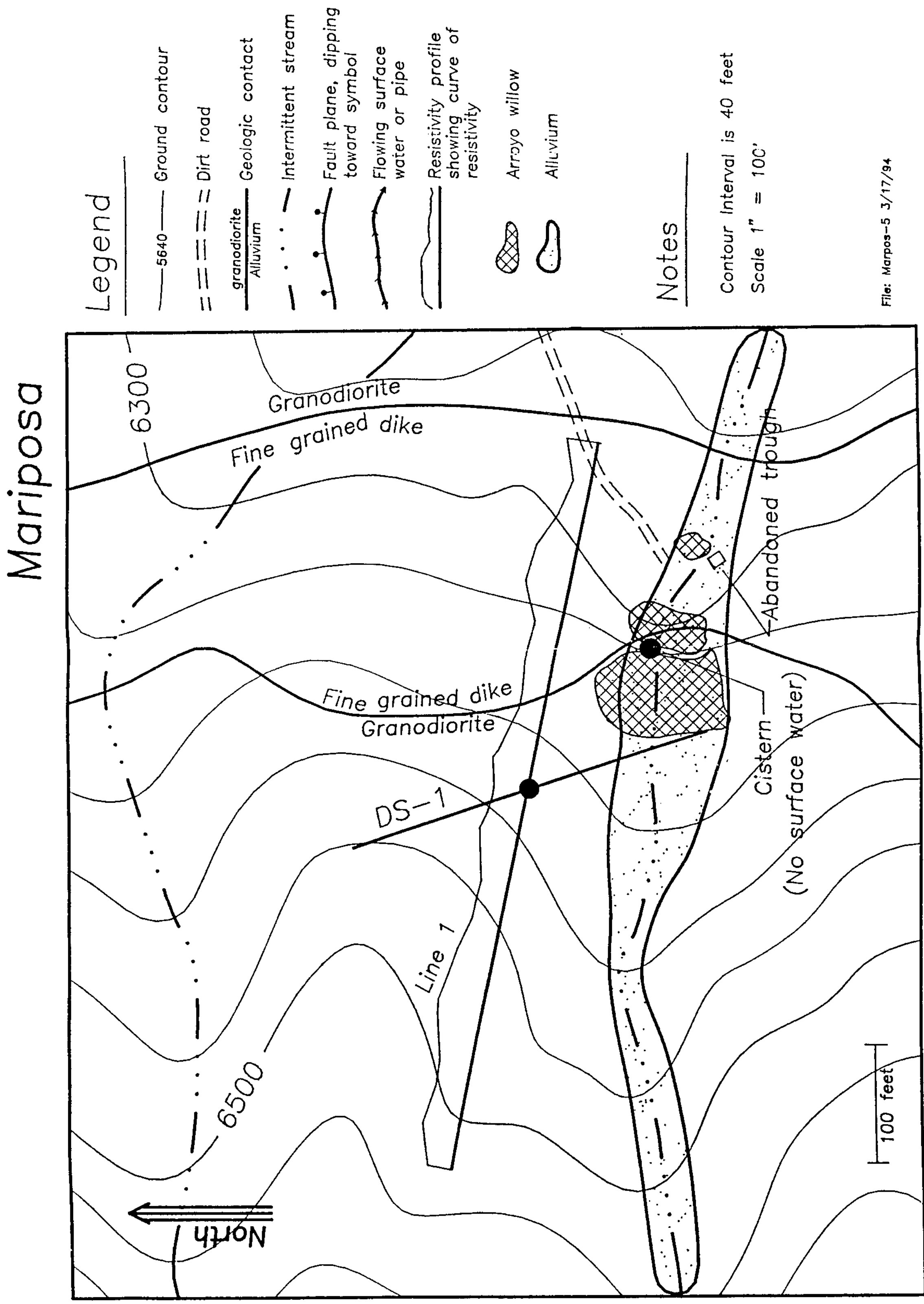

Layton
North
100 Feet
Spring source
Fault
Fence
Watering trough
Ruin
900
910
920
930
940
T. W. Bilhorn, Earth Sciences Consultants
Legend
5640 Ground contour
Dirt Road
granodiorite
alluvium
Geologic Contact
Intermittent stream
Fault plane dipping toward symbols
Flowing surface water or pipe
Squaw water weed
Phreatophytes not ground verified
Notes
Contour Interval is 10 meters
Scale 1" = 100'
File: Laytn-3 3/17/94


Lead Pipe
Legend
5640 Ground contour
Dirt road
Tuff
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity line
Squaw water weed
Phreatophytes not ground verified
Notes
Contour Interval is 40 feet
Scale 1" = 150'
File: LDPIPE-5 3/17/94
402
Possible spring area
100 Feet
North
T. W. Bilhorn, Earth Sciences Consultants
Bedded tuff
Alluvium
DS-2
Resistivity line
DS-1
Surface water
198.3
Fence
Ruin
DS-3
Buried dike dam?
Dike
3200
3160
3120
3080

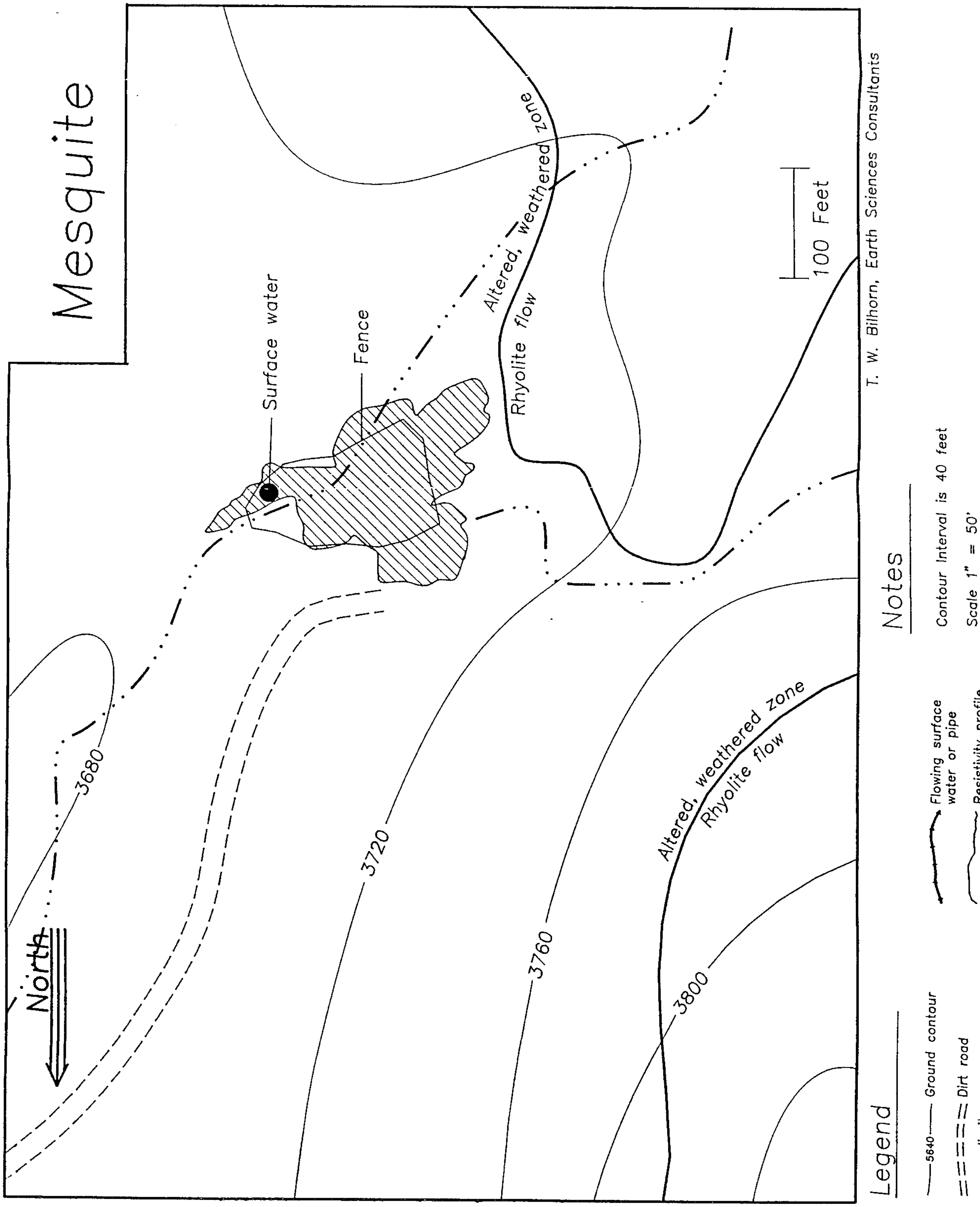


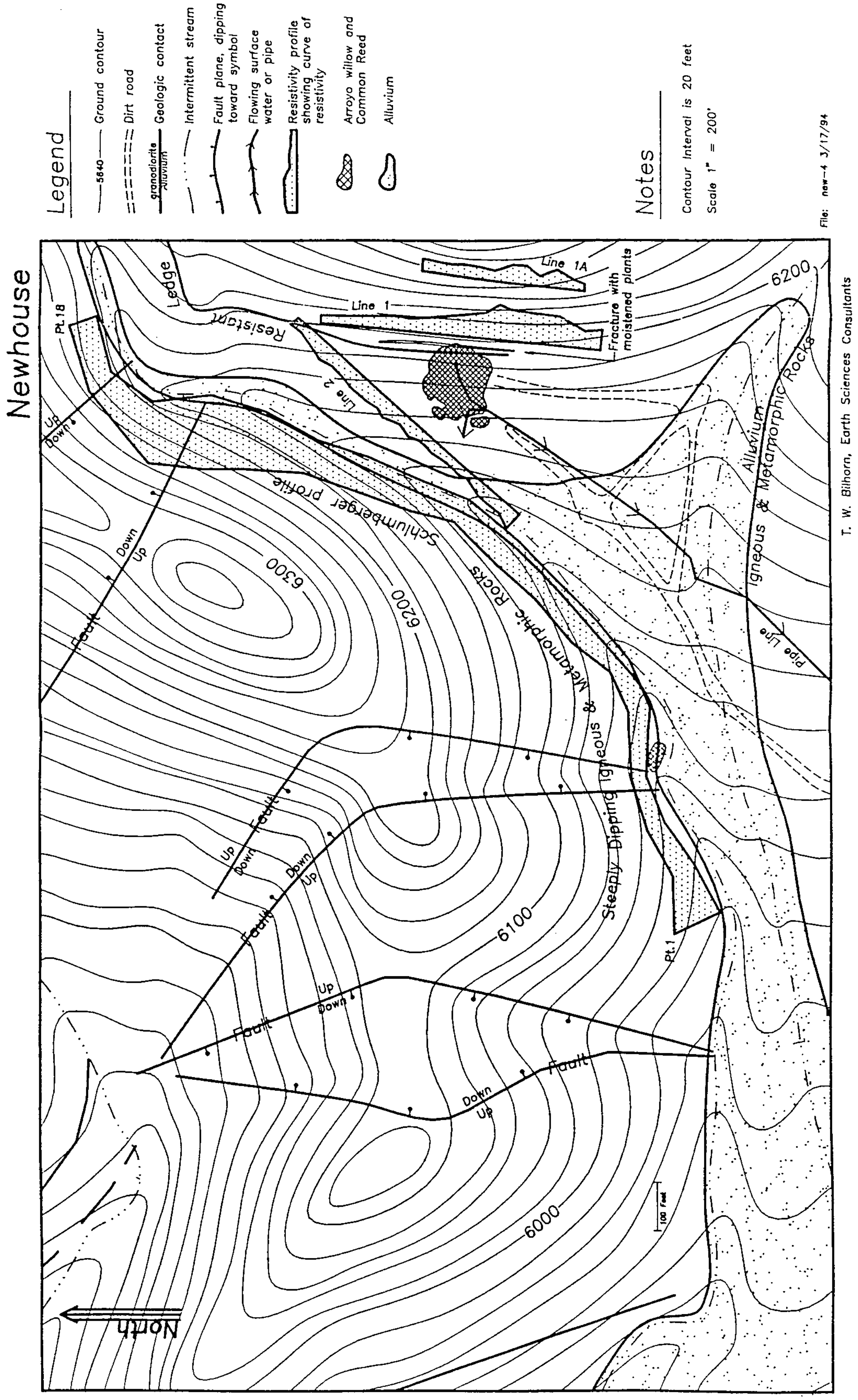
Mammoth Mine
Mountain Springs Road
100 Feet
T. W. Bilhorn, Earth Sciences Consultants
Granodiorite
Alluvium
Granodiorite
5200
5400
5600
Surface Water
North
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Flowing surface water or pipe
Arroyo willow
Alluvium
Notes
Contour interval is 40 feet
Scale 1" = 200'

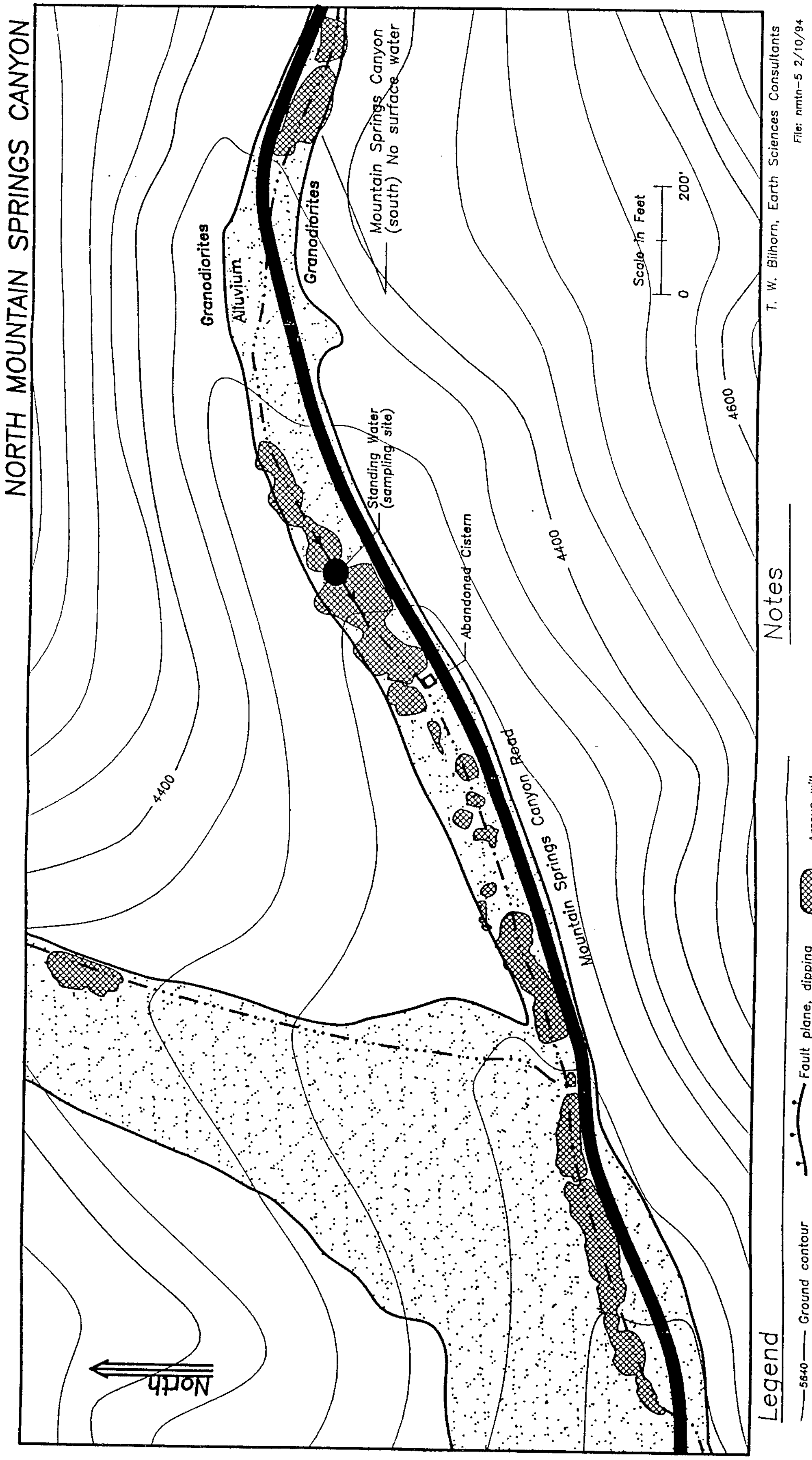

Margaret Ann East
North
Legend
5640 Ground contour
Dirt road
granodiorite / Alluvium Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Arroyo willow
Alluvium
Notes
Contour Interval is 40 feet
Scale 1" = 150'
File: M-Ann-3 3/17/94
Area examined on the ground
Helicopter landing area
Surface water
4600
4600
4800
T. W. Bilhorn, Earth Sciences Consultants

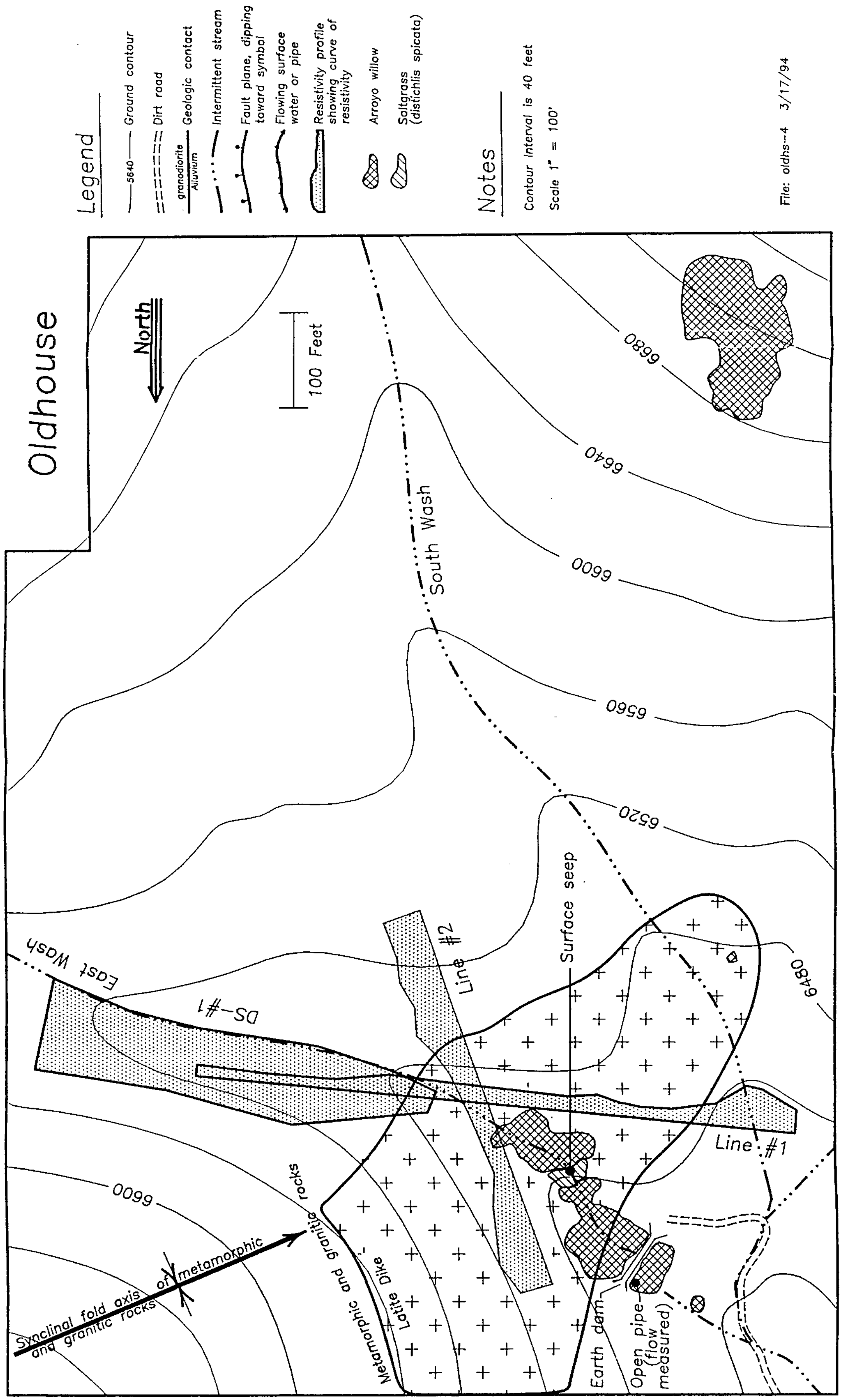


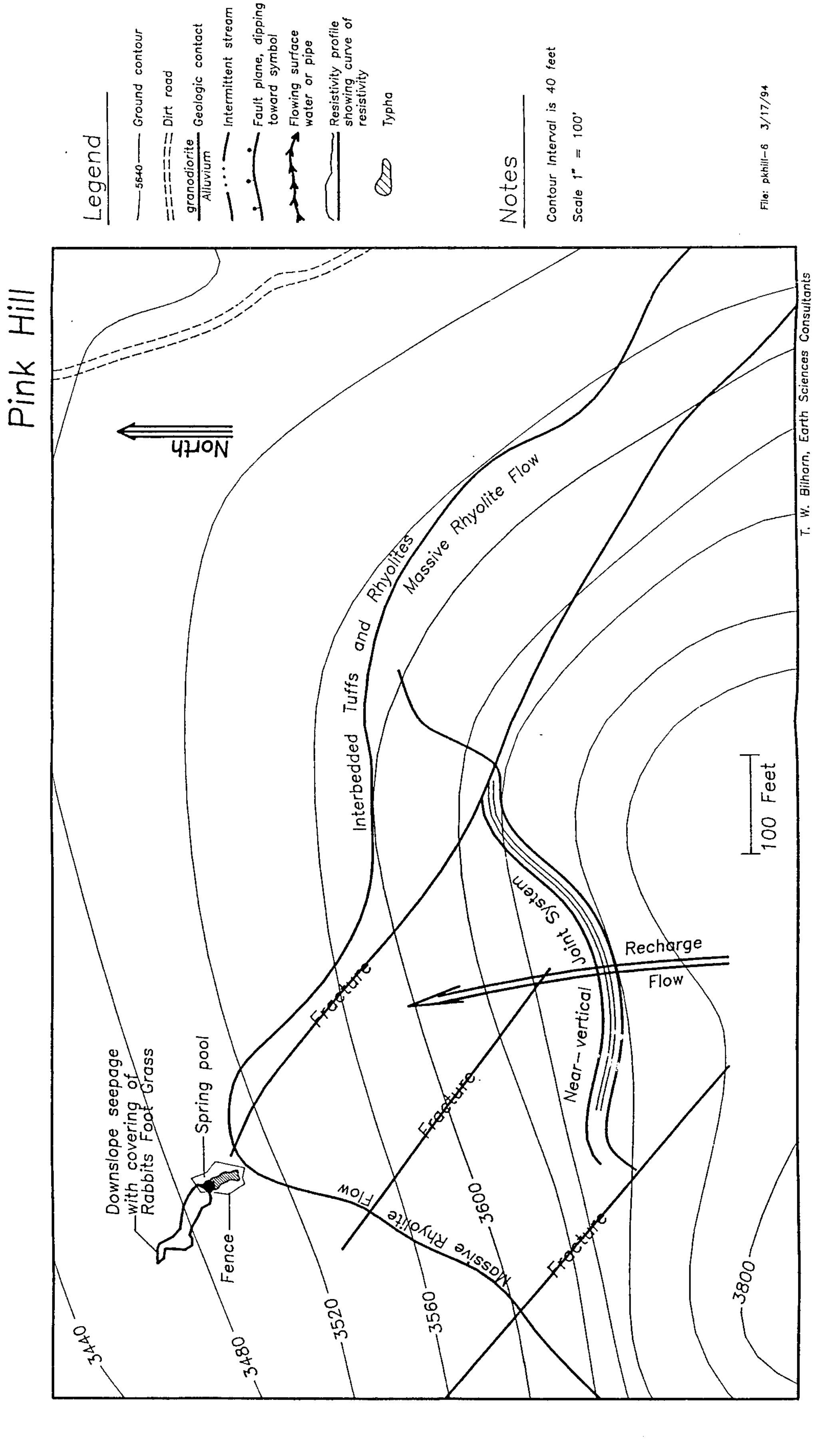
Mariposa
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Alluvium
Notes
Contour Interval is 40 feet
Scale 1" = 100'
File: Marpos-5 3/17/94
6300
Granodiorite
Fine grained dike
Abandoned trough
Fine grained dike
Granodiorite
Cistern
(No surface water)
DS-1
Line 1
6500
North
100 feet
T. W. Bilhorn, Earth Sciences Consultants

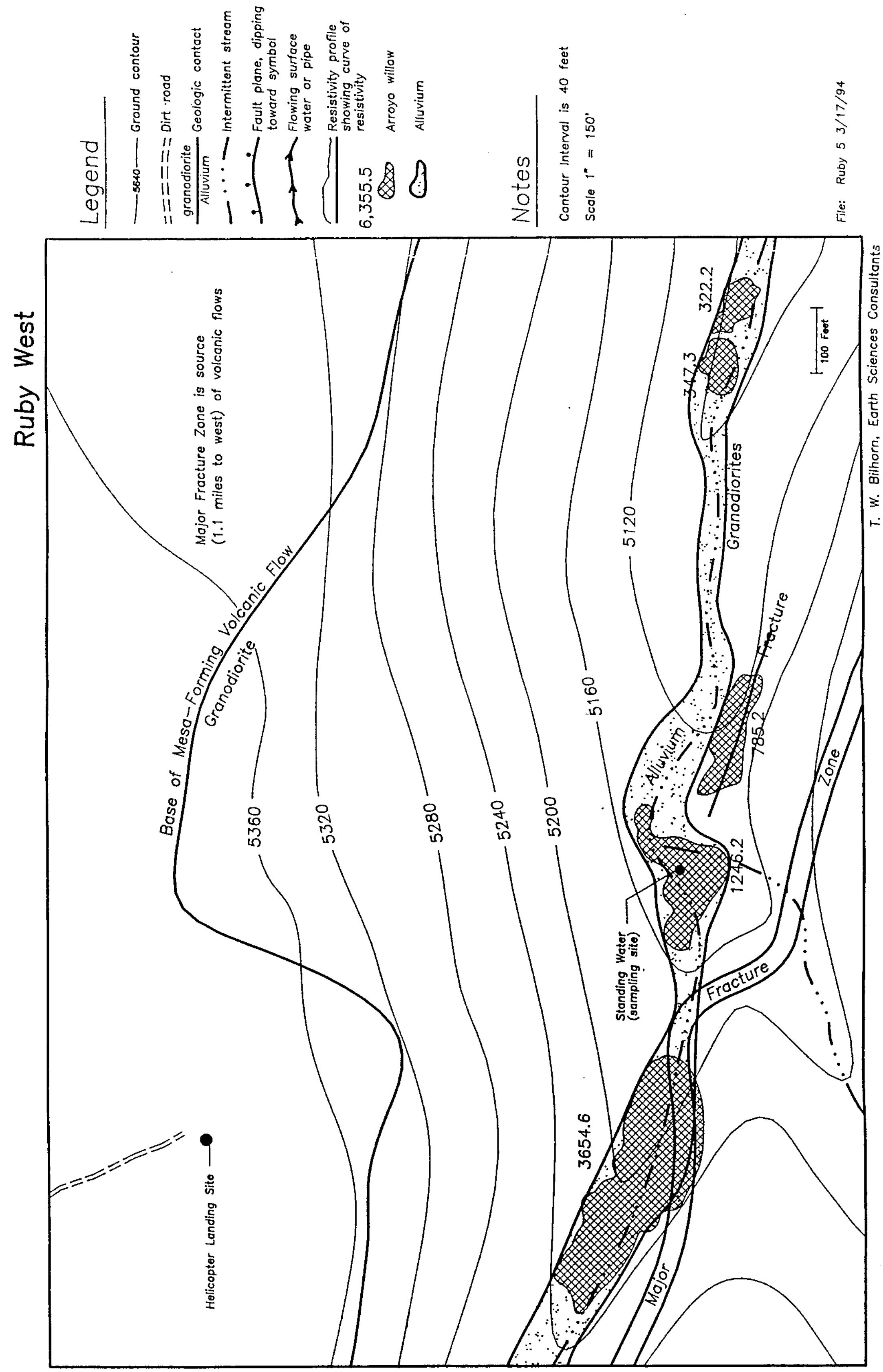

Mesquite
Surface water
Fence
Altered, weathered zone
Rhyolite flow
100 Feet
T. W. Bilhorn, Earth Sciences Consultants
3680
3720
3760
3800
Altered, weathered zone
Rhyolite flow
North
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Mesquite (Prosopis glandulosa)
Notes
Contour Interval is 40 feet
Scale 1" = 50'

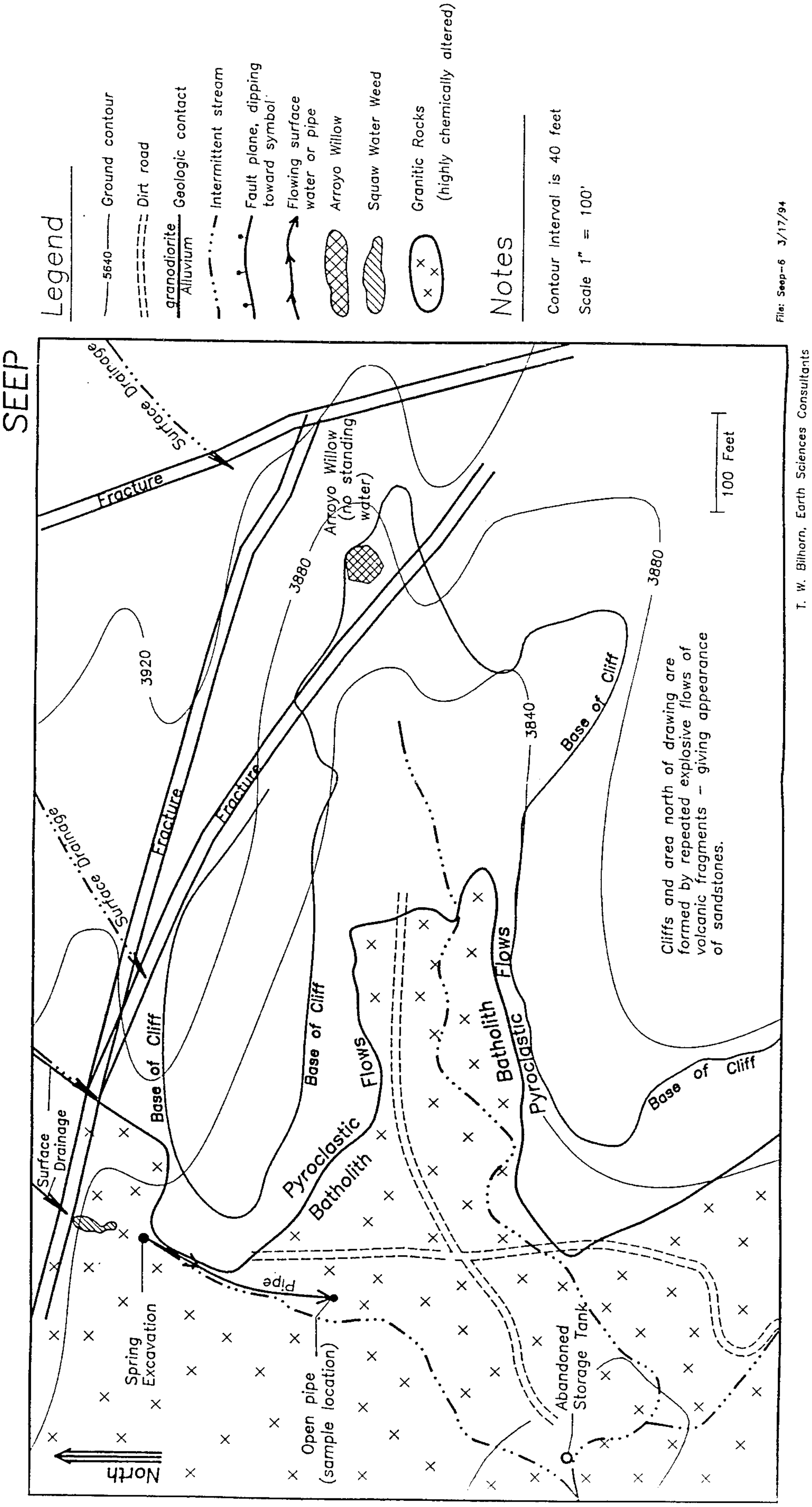

Newhouse
Legend
Ground contour
Dirt road
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow and Common Reed
Alluvium
Notes
Contour Interval is 20 feet
Scale 1" = 200'
File: new-4 3/17/94
T. W. Bilhorn, Earth Sciences Consultants
Line 1A
Line 1
Line 2
Resistant Ledge
Fracture with moistened plants
Schlumberger profile
Steeply Dipping Igneous & Metamorphic Rocks
Alluvium
Igneous & Metamorphic Rocks
Pipe Line
Fault
Up
Down
Pt.18
Pt.1
6300
6200
6100
6000
North
100 Feet

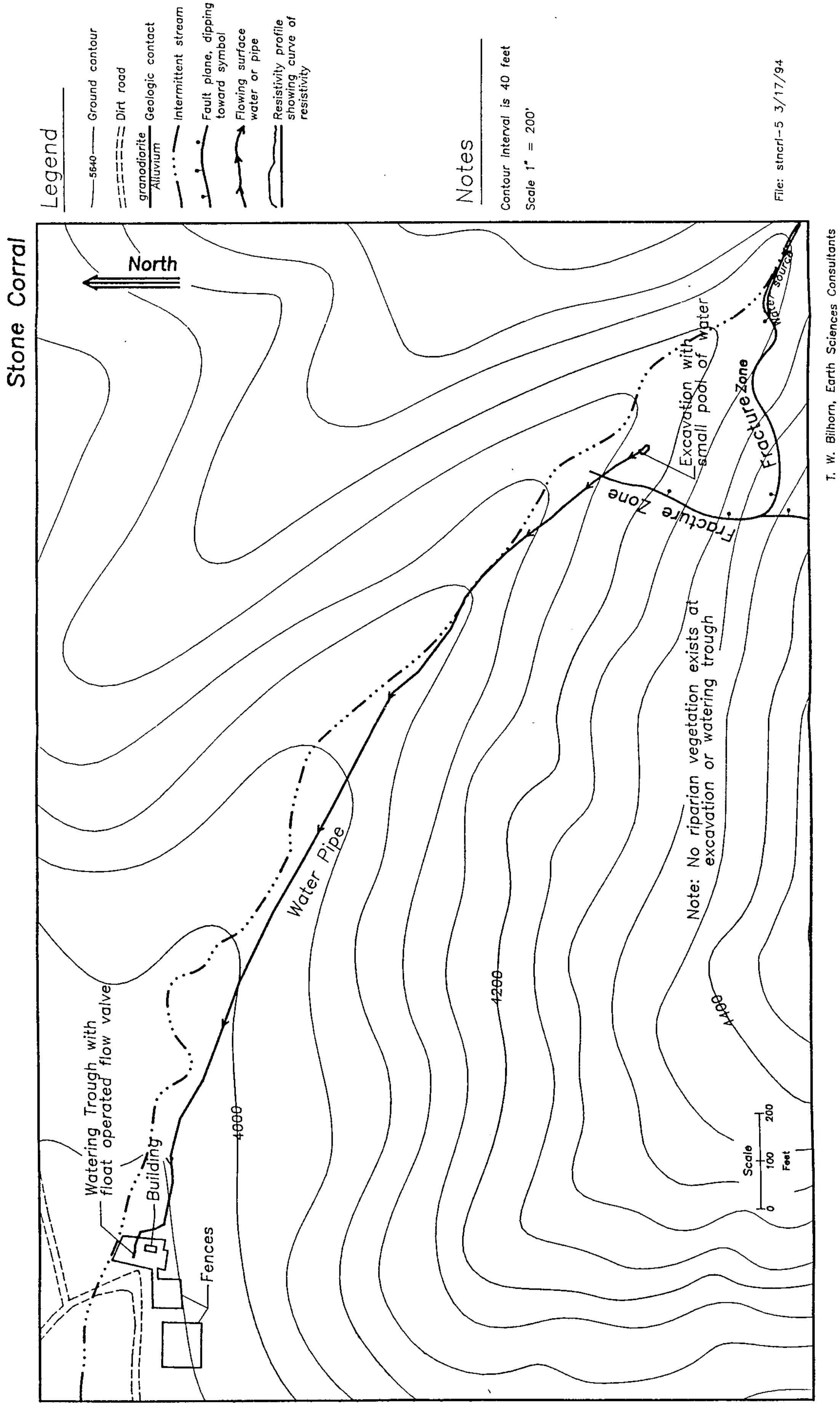

NORTH MOUNTAIN SPRINGS CANYON
Granodiorites
Alluvium
Granodiorites
Mountain Springs Canyon (south) No surface water
Scale in Feet
0
200'
4600
Standing Water (sampling site)
Abandoned Cistern
4400
4400
Mountain Springs Canyon Road
North
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Fault plane, dipping toward symbol
Flowing surface water or pipe
Arroyo willow
Alluvium
Notes
Contour Interval is 40 feet
Scale 1" = 200'
T. W. Bilhorn, Earth Sciences Consultants
File: nmtn-5 2/10/94

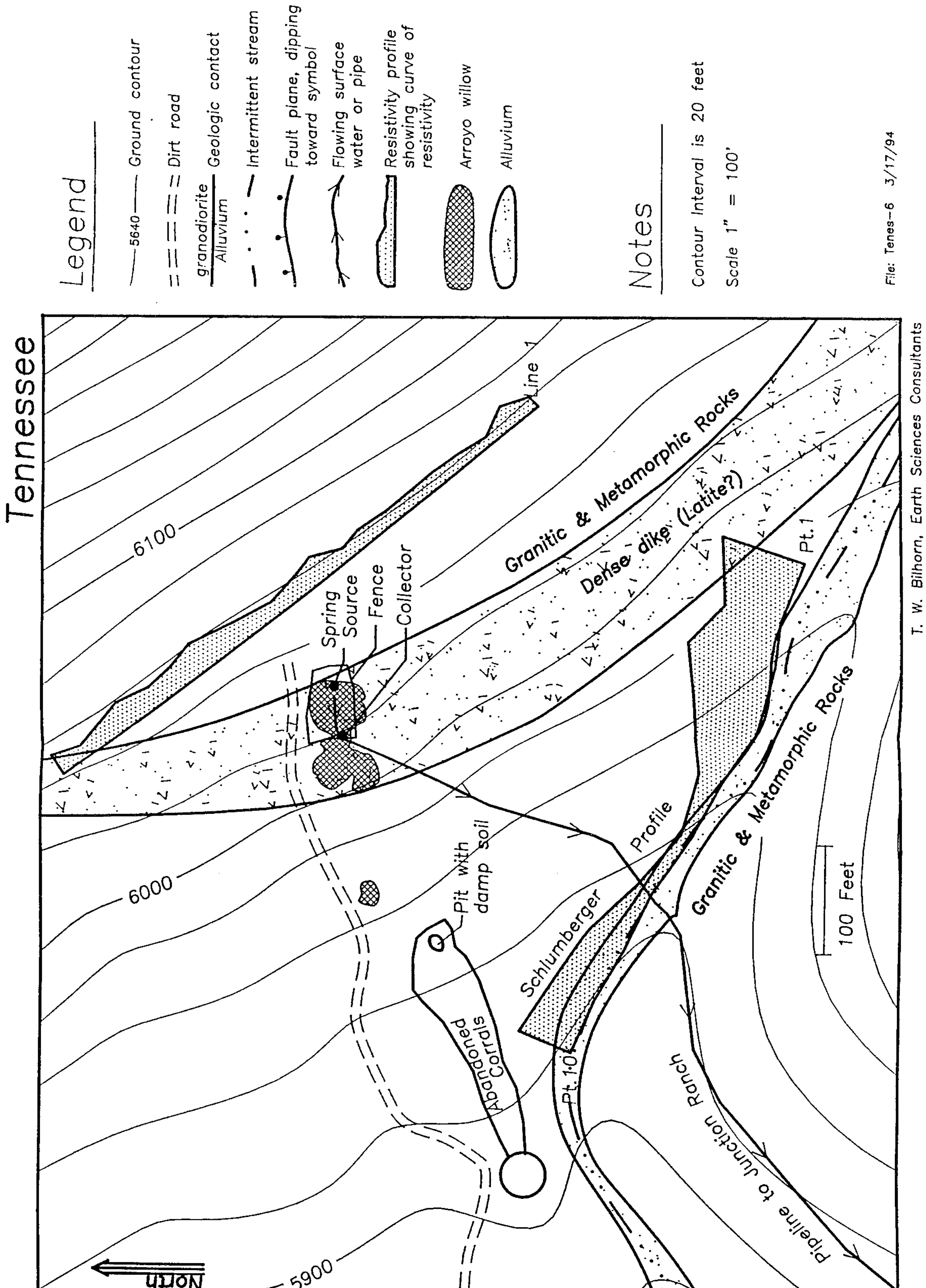

Oldhouse
North
100 Feet
Legend
5640 Ground contour
Dirt road
granodiorite Alluvium Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Saltgrass (distichlis spicata)
Notes
Contour Interval is 40 feet
Scale 1" = 100'
File: oldhs-4 3/17/94
T. W. Bilhorn, Earth Sciences Consultants
6680
6640
6600
6560
6520
6480
6600
South Wash
East Wash
DS-#1
Line #2
Line #1
Surface seep
Earth dam
Open pipe (flow measured)
Synclinal fold axis of metamorphic and granitic rocks
Metamorphic and granitic rocks
Latite Dike

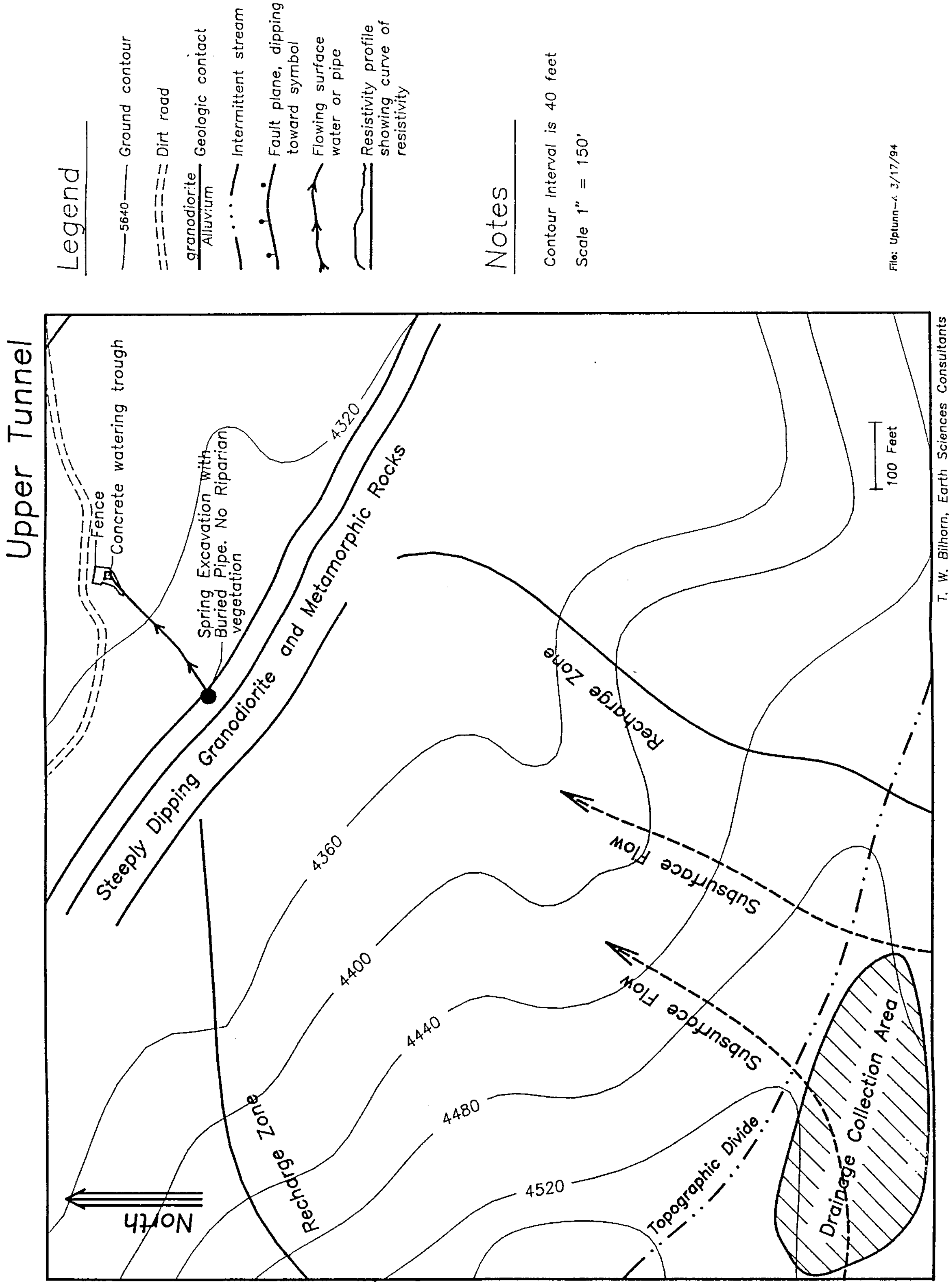

Pink Hill
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Typha
Notes
Contour Interval is 40 feet
Scale 1" = 100'
File: pkhill-6 3/17/94
North
Interbedded Tuffs and Rhyolites
Massive Rhyolite Flow
Near-vertical Joint System
Recharge
Flow
Fracture
Fracture
Fracture
Massive Rhyolite Flow
Downslope seepage with covering of Rabbits Foot Grass
Spring pool
Fence
100 Feet
3440
3480
3520
3560
3600
3800
T. W. Bilhorn, Earth Sciences Consultants

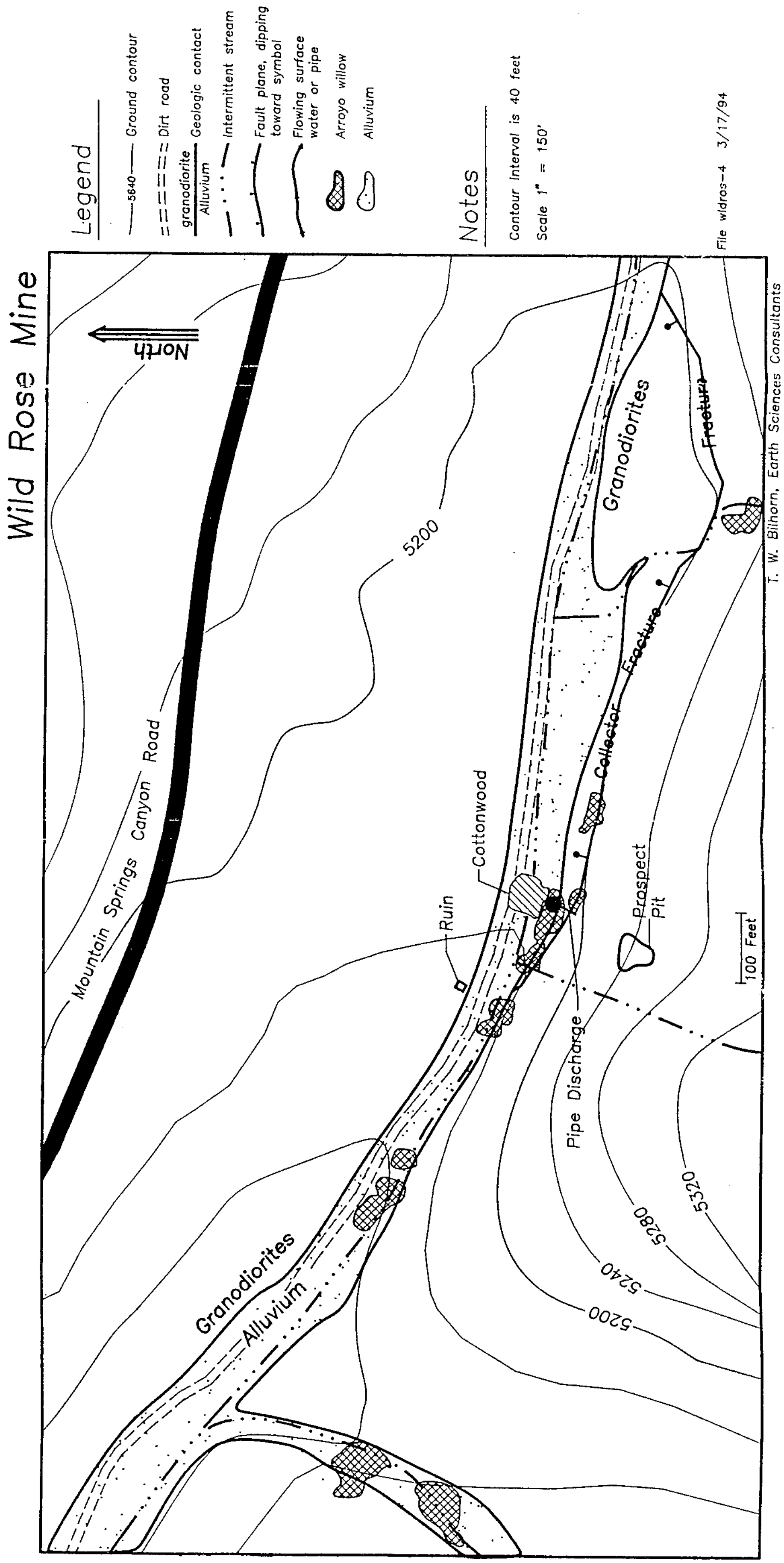

Ruby West
Legend
5640 Ground contour
Dirt road
granodiorite / Alluvium Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
6,355.5
Arroyo willow
Alluvium
Notes
Contour Interval is 40 feet
Scale 1" = 150'
File: Ruby 5 3/17/94
Major Fracture Zone is source (1.1 miles to west) of volcanic flows
Base of Mesa-Forming Volcanic Flow
Granodiorite
Granodiorites
Alluvium
Major
Fracture
Zone
5360
5320
5280
5240
5200
5160
5120
322.2
347.3
785.2
1246.2
3654.6
Standing Water (sampling site)
Helicopter Landing Site
100 Feet
T. W. Bilhorn, Earth Sciences Consultants

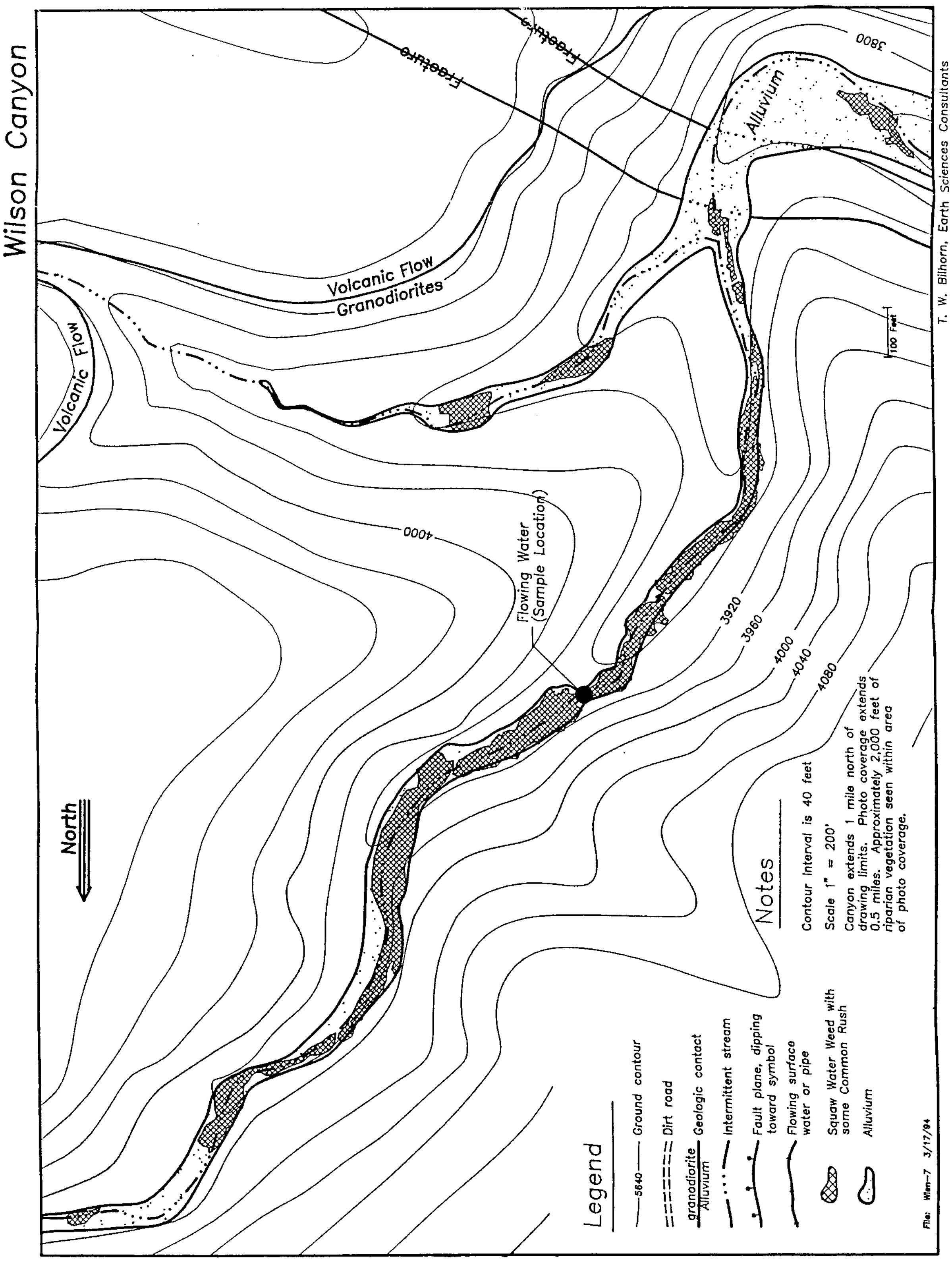

SEEP
Legend
5640 Ground contour
Dirt road
granodiorite / Alluvium Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Arroyo Willow
Squaw Water Weed
Granitic Rocks (highly chemically altered)
Notes
Contour Interval is 40 feet
Scale 1" = 100'
File: Seep-6 3/17/94
T. W. Bilhorn, Earth Sciences Consultants
100 Feet
Surface Drainage
Fracture
Arroyo Willow (no standing water)
3880
3920
3840
Base of Cliff
Pyroclastic Flows
Batholith
Cliffs and area north of drawing are formed by repeated explosive flows of volcanic fragments - giving appearance of sandstones.
Spring Excavation
Pipe
Open pipe (sample location)
Abandoned Storage Tank
North


Stone Corral
North
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Notes
Contour Interval is 40 feet
Scale 1" = 200'
File: stncrl-5 3/17/94
T. W. Bilhorn, Earth Sciences Consultants
Water source
Excavation with small pool of water
Fracture Zone
Fracture Zone
Note: No riparian vegetation exists at excavation or watering trough
Water Pipe
Watering Trough with float operated flow valve
Building
Fences
4000
4200
4400
Scale
0
100
200
Feet


Tennessee
Legend
5640
Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Arroyo willow
Alluvium
Notes
Contour Interval is 20 feet
Scale 1" = 100'
File: Tenes-6 3/17/94
6100
6000
5900
Line 1
Granitic & Metamorphic Rocks
Dense dike (Latite?)
Spring
Source
Fence
Collector
Pt. 1
Pit with damp soil
Abandoned Corrals
Schlumberger Profile
Granitic & Metamorphic Rocks
100 Feet
Pt. 10
Pipeline to Junction Ranch
North
T. W. Bilhorn, Earth Sciences Consultants


Upper Tunnel
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Resistivity profile showing curve of resistivity
Notes
Contour Interval is 40 feet
Scale 1" = 150'
Fence
Concrete watering trough
Spring Excavation with Buried Pipe. No Riparian vegetation
Steeply Dipping Granodiorite and Metamorphic Rocks
4320
4360
4400
4440
4480
4520
Recharge Zone
Recharge Zone
Subsurface Flow
Subsurface Flow
Topographic Divide
Drainage Collection Area
North
100 Feet
T. W. Bilhorn, Earth Sciences Consultants


Wild Rose Mine
Legend
5640 Ground contour
Dirt road
granodiorite
Alluvium
Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Arroyo willow
Alluvium
Notes
Contour Interval is 40 feet
Scale 1" = 150'
File wldros-4 3/17/94
North
Mountain Springs Canyon Road
5200
Granodiorites
Fracture
Collector Fracture
Cottonwood
Ruin
Prospect Pit
Pipe Discharge
100 Feet
5320
5280
5240
5200
Granodiorites
Alluvium
T. W. Bilhorn, Earth Sciences Consultants


Wilson Canyon
North
Volcanic Flow
Granodiorites
Volcanic Flow
Fracture
Fracture
Alluvium
3800
4000
Flowing Water
(Sample Location)
3920
3960
4000
4040
4080
100 Feet
T. W. Bilhorn, Earth Sciences Consultants
Notes
Contour Interval is 40 feet
Scale 1" = 200'
Canyon extends 1 mile north of drawing limits. Photo coverage extends 0.5 miles. Approximately 2,000 feet of riparian vegetation seen within area of photo coverage.
Legend
5840 Ground contour
Dirt road
granodiorite Alluvium Geologic contact
Intermittent stream
Fault plane, dipping toward symbol
Flowing surface water or pipe
Squaw Water Weed with some Common Rush
Alluvium
File: Wilsn-7 3/17/94